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TROUBLES OF SINGLE-PHASE HEAVY TRACTION: CHANGES IN THE NEW YORK, NEW HAVEN & HARTFORD R. R. SYSTEM.*

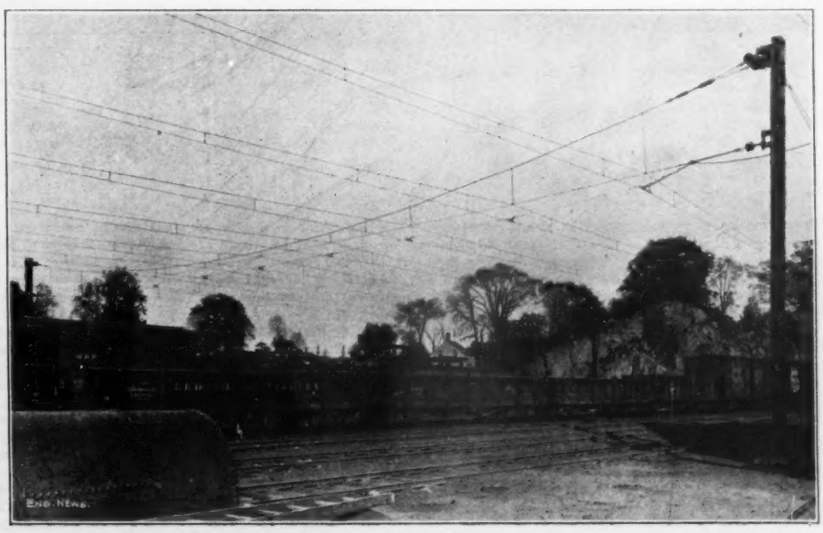
By W. S. MURRAY,† M. Am. Inst. E. E.

The object of this paper is to bring the actual operation of the New Haven single-phase electrification as closely as possible to those who are truly interested in its merits and faults. The writer is not unmindful of the adverse construction and criticism that will be placed by some upon the facts he intends to present. Having carefully weighed this, however, he has concluded that it should not be permitted to stand in the way of, or militate against, the sounder and analytical judgment of those intent upon a fair consideration of the facts as they exist.

The first intention was to make the subject of this paper "The Errors Made in the Electrification of the New Haven System," but realizing what capital such an "admission" would make for those few who are inclined not to be fair-minded on this important matter, the title has been changed, and the body of the paper built upon a description of the faults, major and minor, that have been made, and their effect, by log sheet reference, upon operation.

The duty assigned to the engineers of the New Haven Railroad was to provide for the electrical operation of their trains. At the early period of April 1, 1905, when we settled down to this responsible task, the data in the field, upon which to base real conclusions, were about 5% in comparison with the experience now available. If "I g n o r a n c e maketh the brave," I can only say that I am more than thankful we were so ignorant at the outset. I do not believe that this remark will need any explanation here. Could we have read the history of our errors, rather than have made them, I question whether we would have had the temerity —though I confess our convictions would have been the same—to ask the president of the New York, New Haven & Hartford Railroad Co. to put up with the criticism, abuse and unfair remarks that have been made by those ignorant of the facts, and of others who, perversely, were intent upon their own selfish, narrow course with manifested abandonment of all purposes to acquaint themselves with the nature, the scope and the possibilities which lay easily within their knowledge, merely by the asking. Today I am thankful to say, this negative attitude is giving way to the alarm made manifest by undisputed facts, which demand their own recognition. I have no personal desire to make any other engineer think as I do. If he sees the facts as I see them, then we will vote alike. To those who may be interested in my conclusion in regard to the New Haven electrification, I can simply say that if I were in favor of its use three years ago, that now, standing on the more stable ground of experience, particularly in regard to the department of faults, I am doubly in favor of it today. I shall, of course, be interested in those who share this opinion after reading this paper, but I shall be doubly interested in them if their conclusion has not, in the slightest degree, been influenced by my own, but has been formed entirely upon the contemplation of the faults severally cited. And let me quickly add I shall be equally interested in those who honestly disagree with this opinion.

Unlike steam traction, where the number of links in the delay chain is but one, electric traction has its delay chain composed of three links; namely, the power-house, line and locomotive. A failure in anyone of these links may produce train delay or delays. Measured by the degree of the seriousness of their faults, these links, in the order of their effect on delays, may be mentioned in the order given. This order naturally has application to all forms of electrification, direct-current single-phase, or polyphase.



CROSS-CATENARY SUPPORT FOR CATENARY LINE CONSTRUCTION.

In the conception of the form of power-house, line, and locomotive to be used in the New Haven system, ignorance and lack of experience led those pertinently interested in its success to believe that, while the chain of power generation, transmission and utilization was of a new character, its links, however, were made up of principles long recognized and reliable. They were right in this conclusion, except that it did not include certain phenomena which could not have been then anticipated, due to the combination of these old principles in the form of this new chain. For example, there was nothing particularly disturbing about an 11,000-volt 25-cycle, three-phase power-house, from which was to be taken most of the power from one of the phases generated; or of a 300-ft., 11,000-volt, single-phase transmission line, from the terminals of which the same voltage was to be distributed, east and west, along the right-of-way of a railroad; or, of a locomotive with a transformer installed upon it to take 11,000 volts and step it down to 600 volts to supply 300-volt single-phase railway motors. Power houses of this character have been designed the world over, except perhaps that single-phase current in the amount to be utilized had not been used elsewhere. Transmission lines of 60,000 volts had been in constant use. And, except that there was a moving contact in connection with the current that was to go to the step-down transformers on the locomotives, transformers of many times the capacity and voltage were in universal use. The single-phase motor, indeed, may be said to have been new so far as the size required for the New Haven service is concerned, but tests made upon smaller units demonstrated beyond peradventure its tractive qualities and showed its characteristic curves to be closely similar to those of its prototype, the direct-current motor. This reasoning, in close consideration of each class of apparatus, per se, has proved itself correct, and such irregularities as have existed in the initial electric service, which the New Haven road offered to the public, while deserving the condemnation which the public can unfailingly offer, have been due to the ramification of a series of faults that have developed entirely outside the zone of previous experience. The delays (and public criticisms of them) have followed even into this late day, when the electric service is far better than the steam service it has replaced. It has occurred to me that certain engineers, who are unbelievers in the single-phase system, may interpret this paper as an apology. To them I would say, as I do to the public, it is an apology for having delayed any of their appointments. To others, it is needless to add that the citation of these troubles is given in the hope that they will, as they easily can, avoid them in the future.

THE SERIOUS FAULTS.

POWER-HOUSE.—The electric power supply for the New Haven road is derived from four 11,000-volt steam-turbine generators, three of which have an electric capacity of 3,750 KVA. single phase; the fourth unit consisting of a 6,000-KVA., three-phase generator which can also supply single-phase current to the system.

Although the generators as originally designed were made exceptionally strong, and particular attention paid to their insulation, due to the necessity of grounding one phase, it was found that the utilization of so much single-phase current from a three-phase star-wound generator produced a stray magnetic field completely out of the path of normal lamination. As a result it was impossible to develop for continued operation more than 66% of the normal rating of the generators. Overloads of any character produced abnormally rapid heating, making such operation dangerous, although the generators were guaranteed to carry 50% overload for two hours, and 100% overload for two minutes in order to meet the sudden drafts of currents required for a schedule such as exists on the New Haven road. Indeed, at the very start the actual drafts of current showed that the generators must meet imperatively the guarantees as to normal and overload capacities if the electrification were to be successful. These, then, were the power-house conditions that confronted the New Haven road on beginning the work of propelling alternating-current trains.

After three unsuccessful attempts at complete correc-

*Parts of a paper presented before the American Institute of Electrical Engineers, New York City, Dec. 11, under the title of "The Log of The New Haven Electrification."

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tion, each, however, affording some constructive results—months being absorbed in the dismantling and readjusting of the parts of these generators—the final attempt was successful and the generators are today operating in the power-house, fulfilling the guarantees mentioned previously. But this last mentioned fact is insignificant when compared with the valuable information that has been derived, which will permit all other generators to be manufactured without the fault described.

LINE INSULATION.—The years of experience which we have had in the study of insulating various voltages led to what was considered a very conservative insulation in the various parts of the line. Messenger cables had to be insulated from the intermediate trusses and at their anchor-bridge termini. The copper trolley conductor was suspended from the messengers and had to be insulated at points where it entered the oil switches on the anchor bridges. Trolley wires had to be insulated from each other at section breaks. On curves, both messengers and trolley wires had to be strained over the center of the tracks through the agency of pull-off posts at the side of the tracks, the pull-off wire being insulated between tracks and the pull-off column itself. Feeder wires had to be insulated from their supporting cross-arms and at points where they pass under highway bridges. None of these problems in insulation had the appearance of an especial character and, indeed, did the roadbed provide traffic only for electric trains, the problem would have been simplicity itself. A pressure of 11,000 volts being the prevailing dielectric strain, the problem was to provide sufficient insulation at all the points mentioned above.

Of the effect of steam locomotive discharges upon insulators, there was no initiative by which to be guided, and it became necessary to decide upon the factors of insulation that would be required. It was thought that voltage by transformers, the inductive element to counteract the surging current was practically negligible; under these conditions there resulted short-circuits which no circuit-breaker apparatus then designed could be relied upon to take care of.

Here it is expedient to point out the very marked difference in operating conditions between circuit-breakers used on a system that is grounded and one that is not. In either case, it is, of course, good practice to ground the frames of all circuit-breaker apparatus. In the case of the grounded system, this virtually brings one terminal of the generating system directly to the frame of the circuit-breaker; with the other terminal of the system connected to the jaws (contactors) of the breaker, it is readily seen that on the occasion of a heavy current surge, due to short-circuit, should the arc extend itself through the walls of the oil tank (wherein the circuit is broken), this would be a direct leakage to ground establishing a short-circuit around (or in shunt) to the circuit-breaker jaws, which action, of course, renders the circuit-breaker useless, and subjects it to the damaging effect of the arcing locally produced until interrupted by another circuit-breaker in series with the circuit. On the other hand, where the system is not grounded, even should the walls of a circuit-breaker be broken down, as explained above, there would be no electrical connection (unless the neutral be grounded) between the circuit-breaker frame and the generator, and thus no return path for the current. I desire to draw particular attention to this point, for while the circuit-breakers used in our case open short-circuits, since the current surges have been practically eliminated, I believe that the lining of the oil tanks should have an especially high insulation factor on grounded system.

The failure of circuit-breakers, either in the power-house or on the line, naturally produced train delays of

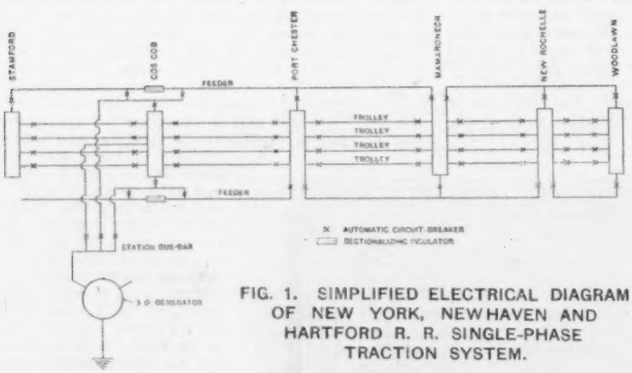


FIG. 1. SIMPLIFIED ELECTRICAL DIAGRAM OF NEW YORK, NEW HAVEN AND HARTFORD R. R. SINGLE-PHASE TRACTION SYSTEM.

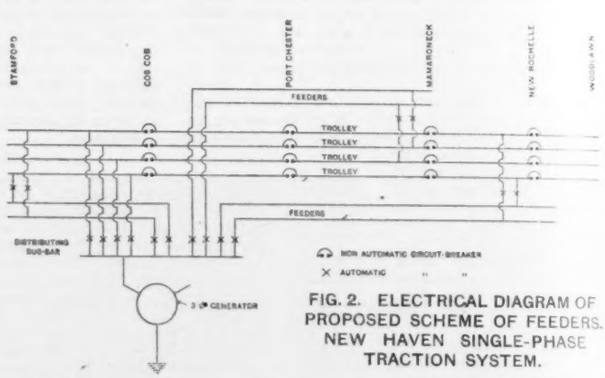


FIG. 2. ELECTRICAL DIAGRAM OF PROPOSED SCHEME OF FEEDERS. NEW HAVEN SINGLE-PHASE TRACTION SYSTEM.

ample provision had been made; it proved otherwise. Experience has proved that, in places, just double the amount is required. It was quickly noted that the greatest number of insulator failures occurred wherever the insulation was subject to the direct blast of the steam locomotive. To correct the difficulty, therefore, it was found necessary to double up on anchor insulators. The intermediate messenger insulators proved adequate and it was not found necessary to increase the impregnated stick insulation between trolley wires at curves, but wood stick insulators had to be added in series with the molded material insulator between the pull-off wire and pull-off post. The original insulators on the anchor-bridge switches were made of molded material and for them was substituted porcelain. It was not necessary to change the feeder insulators on the catenary bridge struts. While very little trouble has been experienced with the form of insulation used for supporting the feeders under highway bridges, it is anticipated that trouble will follow if this is not changed. The present form consists of the corrugated spool-type insulator, for which there will be substituted a regular porcelain double-petticoat insulator.

Today, instead of line failures being the rule, they have become the exception.

CIRCUIT-BREAKERS.—The momentary energy involved in a short-circuit produced upon a line fed by high power, high-speed turbines is very great. Under the sub-title "Power-house" it was stated that the generators were finally operating under their guaranteed capacities. Internal heating, due to stray magnetic field, was the cause of the generators failing to meet their designed capacity. This heating was completely cured by the simple addition of a short-circuited winding surrounding the rotating member of the generator, similar to that used in the well-known squirrel-cage type of induction-motor rotors. It is interesting to note here, however, that while the heating is entirely eliminated by this short-circuited winding, its effect on the occasion of a short-circuit is to allow more current to flow. This tendency, however, is controlled by a method later to be described. In the New Haven system, as the current from the power-house was fed directly to the line and from there to the locomotives without transformation of large or small magnitude. It was difficult to believe at first that these large circuit-breakers were incapable of taking care of the short-circuits, and some time was wasted in thinking this way. Therefore, we reluctantly but surely arrived at the conclusion that the conditions would have to be changed.

The remedy was simple. Instead of feeding the main line with a direct transmission straight from the power-house bus-bars to the trolleys directly opposite the power-house, the current was fed into the line over feeders connected to it at Port Chester and Stamford. By the introduction of this ohmic resistance, amounting to not more than 2% normal drop on the system, we were immediately released from the disastrous effect of short-circuits on our circuit-breaker apparatus. Instead of losing as many as half a dozen circuit-breakers in a day, not that many were reported out of commission for a month, and, of course, they were not damaged to the extent as the others nor did they cause any serious delays.

For the feeder resistance, above described, there has since been substituted impedance coils installed in the leads of the generators. These coils act as shock absorbers, protecting the generators. Later, it is to be expected that there will be installed a circuit-breaker across the terminals of these impedance coils, which, for normal operations, will shunt the current through them, the breakers opening under stress of abnormal flow of current and automatically closing when normal conditions are restored.

TROLLEY WIRE.—In the month of May, 1908, it became evident to us that within at least one month from that date, if some change were not effected in the contact wire, that the New Haven electric service would cease. Daily reports were showing that the copper trolley wire was breaking at various points; and where it was not broken it had become so badly kinked at the hanger points that it was impossible to operate electric locomotives upon the line without serious arcing. This resulted in violent surging on the locomotive transformers, and, at times, on account of the extremely poor contact of overhead shoes on the line, in reducing the voltage to such a low value as to prevent a sufficient supply of power to enable the locomotive to perform its schedule. An examination of the hard-dra[wn] copper trolley wire throughout its length proved that [after] only a few months' operation upon it, its cr[oss] section had been so materially reduced as to point t[o short] life with a continuance of operation upon it. [Especially] was this true in the vicinity of the many [high]way bridges where the trolley wire approaches [the] bridge on a 2% gradient. This fault and dilemma w[as] indeed serious. The cause of the difficulty was per[fectly] apparent; namely, the hard spots in the line w[here] existed at the hanger points.

Many suggestions were offered. None of th[ese] however, offered the speedy installation that w[as] paramount. Mr. McHenry, vice-president of the [rail]road company, made the suggestion that an auxiliary [wire] be suspended from the present copper wire by cli[ps] at its midpoint between the hangers, and followed up [the] suggestion that this auxiliary wire be made of ste[el] the same cross-section as the 0000 grooved hard-dra[wn] copper above it. It took two weeks for the manufac[turer] to draw two miles of this wire. It was installed [imme]diately upon its receipt on the main line betwe[en] Port Chester and Harrison. On the night of its co[m]pleted erection a special seven-car train with two loc[omotives] was operated upon it for several hours. Previ[ous] to the installation of the steel wire there had [been] installed a section of hard alloyed wire suspended [on] a manner similar to that of the steel. The electric [train] was operated upon them both, officials from both the railroad company and the contracting company [being] on hand to note their comparative merits. It was the general consensus of opinion that there was less sparking on the hard wire, and the general tendency was towards adopting that rather than the steel. Though admitting that the operation was better, the steel seemed to be of an entirely satisfactory commercial nature, and all present finally concurred in this conclusion. It is undeniably true that hard alloyed wire would, from a purely operative point of view, be the better of the two, and yet the commercial aspect, which would naturally include its cost, had to be considered, particularly in reference to so large an immediate order as one involving 100 miles of single-phase electric trackage. Again, it is important to note that the steel, besides having the advantage of being a cheaper, harder, and stiffer wire, also possesses a lower coefficient of expansion and higher elastic limit, especially valuable characteristics for the service desired. We found that we would be considerably delayed in the delivery of the steel, but an immediate order of 20 miles followed by another for 40 was placed, and as much hard alloyed wire put up as could be obtained between the date of the conclusion to use the auxiliary wire and the final arrival of the first shipment of steel. The auxiliary wire construction on the main line, as described, prevails throughout the whole system, except at the approaches of and under a few very low highway bridges, where the contact system consists of two wires strung in the same horizontal plane.

The New Haven trains have been operating now on the auxiliary wire for several months, and absolutely no kinking has been noted at the hanger points, with the attendant result of a smooth and almost sparkless overhead contact.

LOCOMOTIVES.—There were originally purchased [35] locomotives, which was considered an adequate number to take care of the New Haven passenger service. Those locomotives, considered per se, were rated on a half-unit basis. That is to say, the half unit was designed to handle about 75% of our trains, the remaining 25% to be handled by two units. Only a short experience in commercial operation revealed two important facts. The first one of a very encouraging nature, the second, decidedly otherwise. The first was the proof that the two main parts of the locomotive; namely, the transformer and motors, had sufficient capacity to more than handle the manufacturer's guarantees. The second was the discovery that many of the auxiliary electrical and mechanical parts of the locomotive equipment were not of equivalent capacity. The strength of the chain be[ing]

measured always by its weakest link, it was immediately seen that the locomotives would be able to handle trailing loads in excess of their guarantees if the auxiliary parts were made of sufficient capacity to furnish the necessary current for the overload conditions. It was simultaneously apparent that more locomotives would be required to provide for an increase of train service and the reduction of time schedule, and an order was promptly placed for six additional ones; before accepting their design, however, a careful survey was made of all the component parts of the locomotives at hand, in order to determine the changes necessary to be incorporated in the six new engines. To accomplish this it was found necessary to make a number of electrical and mechanical changes, the nature of which is apparent in the following tabulation:

MECHANICAL.
- Air Reservoir System. Revised.
- Boilers.
  - Installed.
  - Stack hood removed.
- Bell Rope. Installed.
- Blowers.
  - New Design installed.
  - Guide on present damper rod.
  - Extra guard on shutter.
- Bolster. Reinforced on truck.
- Brakes.
  - New release spring.
  - Cylinder leads lengthened.
  - Check nut on adjuster.
- Compressor.
  - Drip pans installed.
  - Exhaust pipe installed.
  - Air-cooled cylinder head.
- Check-valve. In whistle pipe.
- Gage.
  - On oil tank.
  - On steam line.
- Journal-box. Revised gibbs.
- Quill-plate. Washers installed.
- Running-board. On roof.
- Semielliptic springs. 14 leaf.
- Safety-valve. On control resistance.
- Safety-chain. Made heavier.
- Torque rods. Heavy installed.
- Uncoupling lever. Revised.
- Pony wheels. Installed.
- Valve. On oil line to boiler.

ELECTRICAL.
- Ammeters. Revised.
- Battery. Charging relay installed.
- Blowers.
  - Commutator slotted.
  - Waste rear bearing.
  - Armature laminations ground.
  - Bearing raised above center.
  - Motor winding revised.
- Controller.
  - Bushing riveted.
  - Shoe and trolley switch installed.
- Circuit-breaker.
  - Fused.
  - Tank bolt secured.
  - New type installed.
- Compressor.
  - Commutator slotted.
  - Armature laminations ground.
  - New governor installed.
  - Bearing raised above center.
- Cut-out Boxes. New drums.
- Fuse.
  - In alternating current heater circuit.
  - New auxiliary fuse box (wooden.)
  - Auxiliary motors separately fused.
- Grounding switch.
  - Installed.
  - Control revised.
  - Shutter in cover.
- Heater switch. Shield installed.
- Heater bus-bar line.
  - Reinsulated.
  - Couplers repaired.
- Headlight.
  - Adjusted properly.
  - Porcelain switch installed.
- Motors.
  - Brush holders reinsulated.
  - New cross—connecting leads.
  - Housing asbestos lined.
  - Linen tape on commutator end.
  - Side commutator covers perforated.
  - Perforated S. I. commutator covers.
  - Field clamp bolt secured.
- Motor-generator. New switch.
- Preventive coils.
  - Revised.
  - Supporting frame revised.
- Direct-current relay.
  - Connection to "—S" switch.
  - Washer installed.
- Resistance.
  - Insulated.
  - Capacity increased.
  - Connected ahead of motor.
- Switch group.
  - Revised shunts.
  - Revised studs.
  - Revised arc shields.
  - Copper reverse switches.
  - One-turn blowout coils.
  - Air ports enlarged.
  - Alternating current frames insulated.
  - Cylinder aligning set screws.
  - Reinforcing wooden strip.
  - Interlocked reverse switches.
  - Fitting alternating-current switches.
  - Group covers perforated.
  - New B. O. coil pole-piece alternating current.
- Switch.
  - Block on direct-current case.
  - Main switch, connection modified.
  - Canopy switch handles insulated.
- Shunt remounted.
  - Direct-current ammeter.
- Trolleys.
  - Control revised (alternating current).
  - Side bearing springs (alternating current).
  - Insulate back cross-rod (alternating current).
  - Shield for high tension lead (alternating current).
  - Spring shortened (direct current).
  - Insulator filled and painted.
- Temperature Indicators.
- Third-rail shoes.
  - M. I. bracket.
  - Pin replaced by bolt.
  - Jumper installed.
  - Shoe levers cut off.
- Fuse boxes. Refitted.
- Wattmeter. (Auxiliary) installed.

The most important electrical changes made were in the switch-groups and brush-holders of the motors. The former lacked carrying capacity and the latter sufficient insulation. To these shortcomings were due the greatest number of our first train delays. The most important mechanical changes necessary were the reinforcement of the truck bolsters and installation of pony wheels. The especial reference to these electrical and mechanical changes must not be construed as diminishing in any way the force of necessity of the others, as they were all considered absolutely necessary in order to preserve a low cost of electrical and mechanical maintenance.

With the exception of the installation of pony trucks, the six new electric locomotives arrived within five months of the date of their order. In their design were included all of the changes above specified. To be noted here is the marked value of the spring type of armature and field suspension begun with the New Haven locomotive motors, thus making flexible the entire motor suspension. Indications already predict that this arrangement in combination with the pony trucks will reduce materially the track and locomotive maintenance and repairs. To-day the reconstruction, as above described, has been effected on over 90% of our locomotives.

This last and serious fault with which we had to contend completes the major difficulties that were constantly threatening the regularity of electric service.

It seems to be the time and place, here, to draw attention to a point in design concerning the New Haven locomotives that has been so persistently misrepresented by those who seem to have been ignorant of the facts. The specifications upon which the locomotive units were purchased, as stated hereafter, were that each unit would handle a normal trailing load of 200 tons. The writer, by careful measurement of the weights of all the trains (trailing loads) in the New Haven service, found that they averaged 212 tons. It seemed good engineering that if 75% of the service could be handled by locomotives rated upon a basis of 200 tons trailing load, that that would be the correct locomotive unit size; using two units for the remaining 25% of the trains. To-day, three years after this decision, we find that 73% of our trains can be handled with single units, 27% requiring two units. The percentage is slightly different from the original, as the service is slightly heavier.

Coincident with the use of the first double-unit locomotive trains there was started a rumor that the New Haven locomotives did not have the capacity for which they were designed. To dispel this idea forever, I judge the best argument is to refer to Table IV., wherein are stated the trains whose weights were in excess of trailing loads the locomotives were designed to carry.

I trust that the above clears up any erroneous ideas concerning the capacity of the New Haven locomotives, and will justify the future double-unit trains entering and leaving the Grand Central Station.

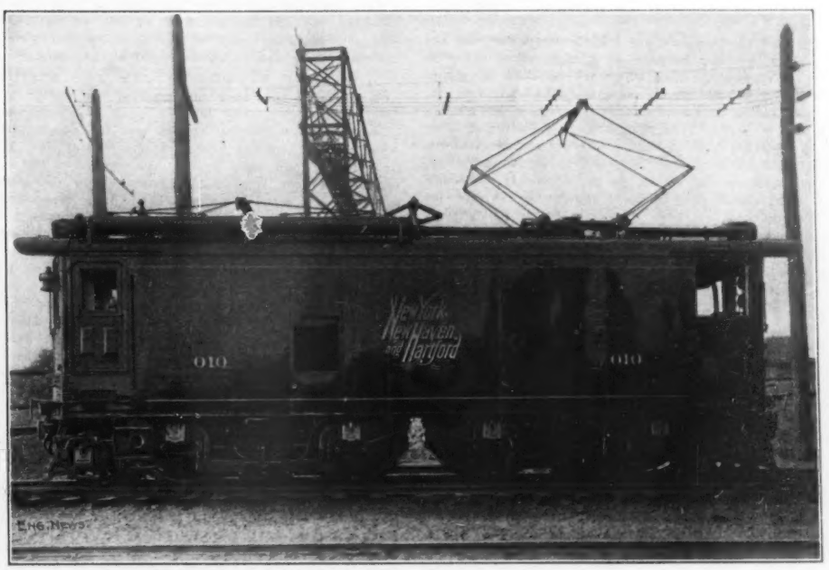


FIG. 3. THE NEW SINGLE-PHASE LOCOMOTIVES OF THE NEW YORK, NEW HAVEN AND HARTFORD R. R.

THE MINOR FAULTS.

GENERATOR BURN-OUTS.—Previously to the rearrangement of the feeders or the installation of the choke-coils in the power station, the short-circuits that were experienced on the line naturally had a deleterious effect on the generators. The prodigious rush of current naturally produced severe strains in the armature windings, strains whose mechanical intensity was made manifest by the movements of the coils. Therefore, during this period of violent short-circuits, frequently the generator coils were grounded and burned out. Since the rearrangement of feeders or the installation of choke-coils, the violent short-circuits have disappeared and with them the damaging effects on the generators. It has been found advisable, from time to time, to connect different generator terminals to the line. By this arrangement the three phases of the generators are in turn worked equally.

DISTRIBUTION.—Although the arrangement of the line in its present feed and trolley connections (Fig. 1) effects the highest economy in loss of power by transmission it is questionable to my mind whether this economy is worth some of the disadvantages which accrue from this arrangement. Until we had experienced the heavy current surges, due to short-circuits, it seemed reasonable that, should a short-circuit occur on the line, the two circuit-breakers which immediately fed that short-circuit would be the ones to respond. We were quite correct in this conclusion, but did not go far enough, as other circuit-breakers seemed to feel it their duty to relieve the situation and their location with respect to the correctly involved breakers was quite varied. Of course the ideal condition would be to have only the two breakers adjacent to the short-circuit open, as by this arrangement the voltage would remain on all trolleys except the one in which the ground is involved. This operation can be effected, and at the time of this writing an effort is being made to obtain these results in practice.

A less efficient method of line transmission (Fig. 2) than that described in the previous paragraph (using the same amount of copper for each case) is one in which each track has its own individual voltage supplied to it and is kept separate from the other trolleys.

Contact wire.—While the auxiliary wire has given an excellent account of itself since having first been placed in operation, it is fair to believe that even a more sparkless operation can be obtained from an auxiliary wire which, instead of being attached by a rigid clip to the overhead copper conductor, is simply suspended from it by a loop, thus permitting the contact wire to rise slightly as the upper pressure of the pantagraph shoe travels along its surface. The contact wire should be anchored by turn-buckles to permit slacking and straining of the wire in winter and summer seasons, respectively.

Hard spots in line.—Irregularities in the contact wire may be due to two causes. First, those that exist in the wire as it is manufactured; secondly, those formed on account of hard spots. The former can be taken out; if not, they are usually ironed out in the course of the operation of the shoe on the trolley. The three principal sources of hard spots are derived from hangers, section breaks, and deflectors.

(1) It has been shown in the foregoing how the hanger hard spots have been eliminated.

(2) The original main-line section-break consisted of a rectangular impregnated wood frame suspended under the anchor bridges. The trolley wires were carried on opposite sides of this rectangle lapping, of course, a sufficient distance in the center so as to permit a short period of simultaneous contact of the shoe with both trolleys, thus preserving continuity of current to the locomotive in passing from one section to another. It was found that these rectangular section breaks were prone to get out of shape, introducing a very rough spot in the line, its effect being, on the passage of the shoe, to draw long arcs which frequently extended themselves to ground. Our new section break, containing all the flexibility obtained by the auxiliary wire, has been constructed by simply staggering the messenger insulators of each trolley 16 ins., thus permitting the anchor-bridge trolley wires of the same track to pass at this distance. Each trolley wire is dead-ended to an impregnated stick insulator, supported by the messenger of its opposite section. By this arrangement practically all inertia is taken out of the section break and a sparkless passage between sections is obtained.

(3) The auxiliary wire construction has been, of course, applied to the deflectors, and this has greatly reduced the tendency to spark at these points. In order to prevent the pantagraph shoe from engaging the wrong trolley wire at turn-outs on diverging tracks, the mesh construction of the overhead frog has up to this time been the only solution, but this method seems unduly cumbersome and even a greater improvement is anticipated than that secured by the application of the auxiliary wire.

Signal wires.—The catenary bridge struts carrying the cross-arms for the by-pass or feeder wires, likewise carry the cross-arms upon which are installed the signal wires. The voltage placed on these signal wires is entirely distinct from the propulsion voltage, it being 2,200 volts and 60 cycles. The proximity of the wires of these two systems has been the cause of short-circuits between them, resulting in double failures. It would seem that as the signal system should be so completely separated from the propulsion system, it should be installed on an entirely separate pole line. If, however, right-of-way conditions make it absolutely necessary that the supporting structures of the catenary system should support also the signal wires, then the two circuits should be made as distinctive as possible, the propulsion system having its wires on the cross-arms on the railroad side of the struts, the signal wires being installed on the opposite.

Locomotive Current Collectors.—An efficient pantagraph shoe has proved itself a very difficult problem. The present cost is about 0.06 ct. per locomotive-mile. We have made various experiments with aluminum, "phono electric" alloy, copper and steel rigid and spring-supported pantagraph shoes. While this feature does not present a serious aspect, it is none the less a most interesting study. Shoe life is also seriously affected by the amount of soot deposited by the locomotives upon the overhead wire. While we have obtained mileages varying between 600 and 1,500 miles per shoe with various types used, other roads of lesser speed and not subject to the effect of locomotive stack discharges, have obtained as high as 25,000 shoe-miles.

TABLE I.—TRAIN-MINUTES DELAY DURING JULY, 1908.

Day	Power house	Line	Locomotive	Total	Cause of delay
1	..	..	40	40	Third-rail shoe. Air hose, third-rail. Train-line hose. One motor of locomotive grounded. Third-rail shoes.
2	..	..	34	34	Third-rail shoes.
3	..	..	20	20	Change-over switch direct-current fuses.
4	..	..	3	3	Pantagraph.
5	..	..	..	..	No delays.
6	..	15	..	15	Circuit-breaker.
7	..	..	..	..	No delays.
8	..	57	3	60	No power direct-current rail.
9	..	..	15	15	Direct current switch grounded.
10	..	13	..	13	Oil circuit-breaker. No power in direct-current rail.
11	..	..	..	..	No delays.
12	..	..	16	16	Control current from storage batteries low.
13	..	..	..	..	No delays.
14	..	..	..	..	Over 300 train-minutes.*
15	..	4	72	72	Circuit-breaker. Preventive coil ground. Pantagraph. Third-rail switch. Motor man failure.
16	..	..	..	..	Over 300 train-minutes. Express left rails at Greenwich.
17	..	12	29	41	Insulator on foreign line broke. Change over switch alternating-current coasting over gap at new bridge.
18	..	..	7	7	Direct-current fuses. Stopping on gap at bridge.
19	..	34	47	81	Line circuit-breaker. Pantagraph.
20	..	..	..	..	Over 300 train-minutes.*
21	..	43	15	58	Line circuit-breaker. Transformer grounded on locomotive.
22	..	..	44	44	Alternating-current controller. Pantagraph.
23	..	..	41	41	Pantagraph.
24	..	..	3	3	Alternating-current controller.
25	..	..	124	124	Pantagraph. Direct-current fuse. Alternating-current controller. Change-over switch. Motor grounded.
26	..	..	..	..	Over 300 train-minutes.*
27	..	..	..	..	Over 300 train-minutes.*
28	..	..	30	30	Pantagraph. Grounded blower.
29	..	8	19	27	Circuit-breaker (line). Transformer-lead ground on locomotive.
30	..	16	..	16	Circuit-breakers.
31	..	..	21	21	Third-rail shoes. Alternating-current switch. Pantagraph.

*Due to simultaneous failure of several circuit-breakers.

THE LOG OF OPERATION.

ELECTRIC PASSENGER SERVICE.—So great was the demand for electric service that in July, 1907, long before we were ready, as the records of our operation have proved, the first commercial service was begun between New Rochelle and the Grand Central station. With all speed possible the electrification was pushed eastward and local service was established from Port Chester in August, 1907. Local service from Stamford followed in October, and finally, on July 1, 1908, all through and local passenger trains were under electric schedule between Stamford and the Grand Central Station. It is, therefore, beginning from this date of July 1, 1908, that I have compiled data of our operation as taken from our records. We are not proud of it, but we believe that you now know of some of the obstacles that stood in the way of its immediate betterment at that time.

COMPARISON BETWEEN STEAM AND ELECTRIC SERVICE.—It had been the hope of the writer to be able, even at this early date, to make an absolute comparison between electric service and the steam service which it has replaced betwen Stamford and New York, including all passenger trains. On account of the speed restrictions that have been introduced on the electric service until all locomotives have been reconstructed with the new pony truck equipment, it is impossible to compare train-minute delays, for the reason that steam locomotives are permitted to make up time while to electric locomotives this privilege is denied. Later, when this restriction is removed, and especially after a period of time more extensive than that offered by the present comparatively short period of operation, these data can be presented. Particularly worthy of notation here in comparing steam and electric service, it is necessary to bear in mind that while the operation of the power-house does not differ from that of ordinary practice, there is a marked individuality (which initiative always brings), in connection with the operation of the line and locomotives. While every credit is due the present organization charged with the responsibility of line and locomotive operation, it cannot be forgotten that these two main links of the system are essentially new in their adaptation to the heavy conditions presented by the New York, New Haven & Hartford train service. Operation of this character is so far beyond the scope of previous experience that it was absolutely impossible to foresee and prevent all contingencies. The methods for the prevention of failure and delay were necessarily based upon the results of actual, practical operation.

[The tables appended are selected, from the many given by Mr. Murray, as showing the typical delays, etc., but not allowing complete comparisons.—Ed.]

It is interesting to note that since the complete inauguration of electric service, the serious failures in the system have been reduced from five to one.

ENGINE REPAIRS.—Under "faults" is described in detail the necessity of our engine reconstruction. Since 100% service has been established, it has occurred to me that the shop reports concerning the daily number of engines which are out of service on account of repairs or for other reasons, would be interesting. On account of the reconstruction being done on the locomotives, it has been found necessary to give up on an average three electric locomotives at Stamford and three at New Haven, the new bogie trucks being installed on the engines at New Haven. Thus out of 41 locomotives we have had only 35 to handle the complete passenger service. This has resulted in requiring that the New Haven locomotives handle the service with virtually no spare engines. An examination of the tables under columns "Inspection" and "Repairs," indicating how few have been the engines in the shop for the past three months, is an attest of this requirement.

THE CAPACITY OF THE ELECTRIC LOCOMOTIVE.—The capacity of the electric locomotive was based upon their ability to handle a trailing load of 200 tons in local service with stops averaging those that exist between stations between New York and New Haven. As a matter of fact, the station stops between Stamford and New York average very much greater than between New Haven and New York, and as very quick turns are made at both termini, the service may be said to be more severe under these conditions than under the guaranteed conditions of purchase. It is interesting to note in Table IV. the trailing loads, taken at random, hauled by the New Haven electric locomotives Oct. 23, 1908.

RELATION TO MATTERS OTHER THAN TRACTION.

TELEGRAPH AND TELEPHONE.—Single-phase traction affects telegraph and telephone systems when wires lie parallel with and in close proximity to the railroad. The corrective for this disturbance has proved to be simple and not costly. Briefly described, it consists of compensating transformers whose secondaries are a part of the telegraph and telephone wires and whose primaries receive their voltage from pilot wires strung on the same cross-arms as those bearing the telegraph and telephone wires, and thus having impressed upon them the same voltage, by electromagnetic induction, as the telegraph and telephone wires. The transformer secondary voltage is approximately equal and opposite to the induced voltage on the telegraph and telephone wires and thus constantly compensates for it throughout all ranges of induction due to the single-phase wire.

An interesting commentary on the efficacy of the compensating transformer is that its use obviated the necessity of any change in the physical location of the telegraph and telephone lines within the zone of induction, and has thus been the means of removing what at first was rightly considered a very offensive attribute of the single-phase system.

PUBLIC SAFETY.—As no fatality to the travelling public has happened by reason of the high-voltage wires since the system has been in operation, this would indicate the safety involved in its construction. On the other hand, the feeder or by-pass wires are not suspended by messengers, and although the 300-ft. spans used in this construction are not uncommon, it has been considered a wiser policy to reinforce all such spans which are above passenger platform stations. It may be of interest to state also that the scheme of reinforcement is not to cradle or place supplementary wires in connection with this span, but simply use a steel wire with a large factor of safety reinforced by copper for conductivity conductor and supported from the struts by insulators. The resistance to ground of this construction will be far in excess of the ordinary insulator used in the open construction with the steel wire connected to it in such a manner as to make impossible the burning of this wire in two in the case of the insulator breaking down.

FOREIGN WIRES.—All electrifications are subject to foreign wire crossings. As in the case of suspension of high-voltage wires over passenger platforms, instead of using supplementary catenaries or cradles, the safer (and incidentally the cheaper) method of crossing is to use at the crossing heavier (and possibly guyed) poles, better insulation, and larger wires than are commercially necessary in the other parts of the foreign transmission

TABLE II.—DAILY LOCOMOTIVE REPORTS, AUGUST, 1908.

Date	Reconstruction	Experimental & test	Trucks installed	Inspection	Repairs	No. of trains	Cause of repairs
1	1	..	1	..	1	141	Trucks.
2	..	SUNDAY		..	..	..	
3	2	..	1	..	2	135	Truck springs (1). Blower motors (1).
4	2	..	1	1	..	133	
5	1	..	1	1	1	134	Changing motors
6	1	..	1	2	1	131	Changing motors
7	..	..	1	..	2	133	Compressor grounded (1). Trucks and reconstruction (1).
8	1	1	..	..	2	136	No. 1 Main Reservoir leaking. Trucks and reconstruction (1).
9	..	SUNDAY		..	..	..	
10	1	..	..	..	1	135	Trucks and reconstruction
11	1	..	..	1	1	133	Trucks and reconstruction
12	1	..	..	..	3	133	Grounded direct current relay (1). Loose tires (1). Trucks and reconstruction (1).
13	1	..	..	..	1	133	Trucks and reconstruction
14	1	..	..	..	1	134	Waiting for wheels from Readville.
15	1	..	..	..	1	138	Waiting for wheels from Readville.
16	..	SUNDAY		..	..	..	
17	1	1	..	1	2	133	Direct current shoe cables grounded. Waiting for wheels from Readville (1).
18	1	..	..	..	3	133	Circuit-breaker trouble (1). Direct current shoe cables grounded. Waiting for wheels from Readville (1).
19	1	..	..	..	1	133	Waiting-wheels. Readville.
20	1	..	..	1	1	139	Charging compressor
21	2	..	..	1	..	133	
22	2	..	..	2	..	137	
23	..	SUNDAY		..	..	..	
24	2	..	..	..	1	135	Grounded motor
25	2	..	..	..	2	133	Grounded motor (1). Grounded armature (1).
26	2	..	..	..	0	133	Grounds, due flood, N. Y. Central zone.
27	2	..	..	..	5	133	M.I. switch-group grounded. Grounds, due flood, N. Y. Central zone (4).
28	2	..	..	..	2	133	Grounds, due flood, N. Y. Central zone
29	2	..	..	..	2	141	Grounded motors (2)
30	..	SUNDAY		..	..	..	
31	2	1	..	..	..	143	
Total	36	3	6	10	45	3502	(Total daily trains)
Avg.	1.38	0.11	0.23	0.38	1.73	135	(Average).

TABLE III.—DAILY LOCOMOTIVE REPORTS, OCTOBER, 1908.

Date	Inspection & oiling	Experimental & test	Trucks installed	Inspection	Repairs	No. of trains	Cause of repairs
1	3	1	2	..	..	126	
2	3	..	2	..	..	126	
3	3	..	2	..	..	129	
4		SUNDAY		..	..	..	
5	3	..	2	..	..	126	
6	3	1	2	..	..	124	
7	3	..	2	..	..	124	
8	3	..	1	..	1	125	Sharp flanges.
9	3	..	2	..	..	125	
10	3	1	2	..	..	129	
11		SUNDAY		..	..	..	
12	3	..	2	..	..	125	
13	3	1	2	..	..	126	
14	3	..	2	..	..	124	
15	3	..	2	..	..	124	
16	3	1	2	..	..	124	
17	3	..	2	..	..	126	
18	..	SUNDAY		..	..	..	
19	3	..	3	..	..	125	
20	3	1	2	..	1	124	Turning flanges.
21	3	..	3	..	..	126	
22	3	..	3	..	..	124	
23	3	..	2	..	1	125	Grounded motor.
24	3	1	2	..	..	126	
25	..	SUNDAY		..	..	..	
26	3	..	3	..	..	125	
27	4	..	2	..	..	124	
28	4	..	3	..	..	124	
29	4	..	2	..	..	124	
30	3	..	3	..	..	124	
31	3	..	3	..	..	126	
Total	84	7	60		3	3380	(Total week day trains.)
Avg	3.10	0.26	2.22		0.11	1250	(Average.)

line. High factors of safety with economy are obtained following this policy.

LIGHTNING PROTECTION.—An ideal arrangement of catenary construction in relation to lightning protection would be to have the overhead messenger system grounded, and from it suspended by insulators a secondary catenary system, to which in turn would be attached the contact wires. Even in the New Haven case, where the overhead messenger system is not grounded, lightning has given but slight trouble. This is probably due to the very great number of grounded steel trusses and struts projecting above the electrified wires. Lightning was the indirect cause of one of our delays, but played only a small part in the real cause which can be attributed to the surge of current occurring at the time lightning caused a ground. At that time the feeders had not been rearranged, nor had the impedance coils been installed in the power-house circuits. On the occasion of this ground, due to the lightning, we lost several of the anchor bridge circuit-breakers; this naturally tied up the distributing system, preventing the proper restoration of voltage to the trolley wires. The conditions are now such that the circuit-breakers will relieve short-circuits due to this cause.

GROUNDS.—Structures supporting high-voltage insulators should be grounded. Particularly is this true of structures foreign to the railroad company, such as highway bridges. This arrangement insures a prompt response of the circuit-breaker apparatus, and carries out the good practice universally applicable, that the material supporting the insulator be grounded. This principle has application in wood-car construction. Positive grounds between Pintsch gas pipes and both car tracks should be made to avoid any arcs being drawn under the car body. On two occasions the gas in the Pintsch mains of New Haven cars has been set on fire on account of connection with electrified wires. While the percentage is low, being two cars in about 400,000 during the period involved, with little damage in either case, and that to the cars, it is a matter not to be ignored.

Many of our catenary bridges of both the intermediate and anchor type, serve to support signals. Signal men have been entirely free from coming in contact with the high-tension wires, by the simple provision of grounded close mesh screens interposed between the signal platforms and the high-voltage wires. The value of two grounds can be rated considerably higher than twice that of one.

TELL-TALES.—Tell-tales in connection with an overhead system offer a peculiarly difficult problem. It is quite apparent that the pantagraph current collecting device would get into either electrical or mechanical difficulties with the present form of tell-tales. We have experimented at some length in trying to produce an electrical horn that would be automatically sounded by an approaching train. There is nothing particularly difficult in getting the automatic action or in producing a noise. The superiority of the tell-tale over the horn, however, is that no matter how much noise the freight train is making, the tell-tale always notifies, while in the case of the horn should the freight train be making more noise than it, the notification is lost. A horn if used for this service should be a large one.

As a matter of fact, the necessity of tell-tales is a bit of a relic of the barbaric past. In the days of hand brakes, the brakeman had to walk the roofs of cars, and low bridge warnings were necessary. Today the braking is all done from the engine cab, except in yards where, of course, the overhead wires have their normal height of 22 ft. from the rails, permitting safe clearances for manual operation of the brakes.

TRAIN LIGHTING AND HEATING.—On account of the necessity of wiring for electric heating and lighting some 2,500 coaches, it seems reasonable to retain the present method and apparatus of heating and lighting the trains in the electric zone. To accomplish this it was only necessary to supply each electric locomotive with a small steam boiler used solely for train heating. The Pintsch gas system has been retained intact. Later, when the service is sufficiently extensive, all trains will be heated and lighted by electricity.

All multiple-unit cars are to be heated and lighted by electricity. The problems of heating and lighting a multiple-unit train and a locomotive train are quite different. In the former the current is fed into the train at several points, as many as there are motor cars; in the latter it can be taken only from the locomotive (if there are two locomotive units, of course, it can be supplied from both). Again, in the case of the multiple-unit equipment, the supply of current is along progressive points of the train-length, thereby not requiring train bus-bars of excessive copper section, while in the case of the locomotive train, the supply, whether from one or two units, will be at the head end of the train, thus requiring a transmission of considerable length. A train of 12 cars, for instance, would be between 700 and 800 ft. long. Allowing 24 KW., maximum, for heat and light per car, would require the delivery of about 300 KW. apparent power. An investigation of this department in electrification has brought out some interesting details, particularly in reference to locomotive transformer design and electric car jumpers.

FATALITIES.—As has been pointed out, we have had several fatal accidents, due to men coming in contact with electrified wires. We are none the less concerned that in every instance they were men employed by the company. In each instance the accident was due to carelessness or violation of instructions, and most of the accidents occurred during the period of construction. The operating period has provided a less number of these unfortunate events, and the records today now seem to indicate that the future will be free from this most regrettable feature.

CROSS-CATENARY VERSUS BRIDGE-BENTS.—The excellent results of a year's experience with cross-catenary construction in our Port Chester yard, where as many as ten tracks are spanned, is tempting encouragement for its application to main-line work. Should the cross-catenary be used, anchor bridges should be spaced at close intervals, say one per mile. The question of the use of cross-catenary versus the bridge-bent on multi-track roads, however, depends largely upon the right-of-way conditions. Cross-catenary struts have to be guyed. In many instances right-of-way limits will require the guy to be placed on foreign land. If the additional cost of the foreign land brings the catenary bent up to or more than the cost of the bridge-bent it loses its object.

SINGLE VERSUS DOUBLE-CATENARY CONSTRUCTION.—Lack of operating data led the engineers of the New Haven road to take no chances with the overhead construction, and the double catenary was considered the safest. The adoption of single, double, and compound systems of catenary suspension is so intimately and definitely related to the number of tracks, the length of longitudinal spans, and the cost of transverse supporting structures and foundations, that the determining of the most economical type of catenary construction must necessarily include the consideration of these factors, and for this reason simple standardization adapted to all conditions is impossible.

SINGLE-PHASE OPERATION.—The New Haven system provides that the volt manufactured in and leaving the doors of the power-house, is the same physical volt that knocks at the doors of the locomotives. Thus the line is the single link that unites the power-house and the locomotives. All such adjuncts as step-down transformers, synchronous converters, storage batteries, and low-voltage distributing systems with their necessary attendant complement of help is dispensed with. The Cos Cob power-house has the usual number of men for a station of its output, and the locomotives are operated by the electric locomotive engineer with the customary assistant present for emergency. This crew holds good for single or double-unit trains. An emergency repair train is the guardian of the line, attending to all matters pertaining to its repair and maintenance. Including the night and day crews of the emergency train, the number of men employed to maintain the distribution system is nineteen. This covers about 100 miles of single track, including yards.

CONCLUSION.—The writer will not use the conventional method of summing up and making recommendations. The paper has been written with the intent to lay before the members of the American Institute of Electrical Engineers a practical picture of the New Haven single-phase electrification, describing the first suit of clothes it wore and what it is wearing now. He is conscious of the innumerable little points of real interest that time and opportunity have not permitted him to insert here, but he trusts to the discussion to bring them out. The description of the faults and how they were handled will answer for the usual column of recommendations. In concluding, an interesting definition of engineering comes to mind; namely,

Engineering is the art of making a dollar earn the most interest.

The writer has intentionally omitted the discussion of the operating costs of a direct-current versus an alternating-current system; but, bearing in mind the preceding definition, it is his belief that in the electrification of steam roads today straight alternating-current traction is the agency through which that title can be earned.

History sustains the undeniable truth that alternating-current is the preferred agent for the transfer of electricity where either distance or capacity is involved. A railroad involves both. Granted, therefore, that the alternating-current traction apparatus has received the trade mark of practicability, what further argument does it need in its favor?

This paper would indeed be incomplete did I not refer to the courage and pluck of our contractors, who through a fire of criticism and business depression perseveringly stuck to their belief in the principles they were advocating. They can now have the satisfaction of viewing something begun and something finished; for while there may be many improvements to accrue to the alternating-current, single-phase system, the trunk-line principles have by them been laid and demonstrated.

TABLE IV.—TRAILING LOADS IN EXCESS OF LOCOMOTIVE GUARANTEES, OCT. 23, '08.

Service.	Train No.	Loco. No.	Trailing train weight.	Percentage over weight.
S. Ex.	21	013	339	35.6
S. Ex.	55	012	320	28.0
S. L. Ex.....	246	02	263	5.2
S. Ex.	15	010	377	50.8
S. Ex.	11	05-08	542	8.4
S. Ex.	56	024	313	25.2
S. Loc.	252	027	260	34.5
S. Loc.	215	09	241	20.5
S. Loc.	206	02	233	16.5
S. Loc.	207	03	245	22.5
P. C. Loc.....	181	028	318	27.2
S. Ex.	1	017-041	747	9.6
S. Ex.	2	03-011	853	70.4

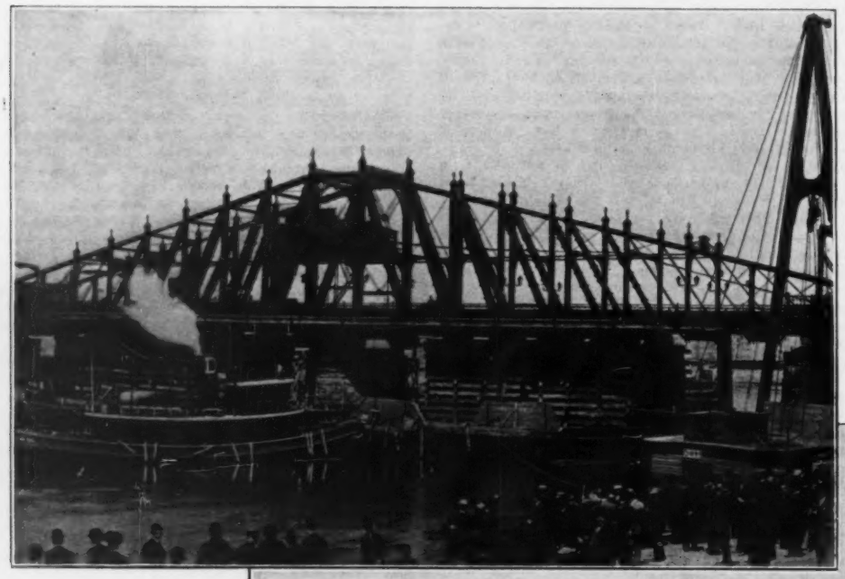
LECTURES ON THE VARIOUS MUNICIPAL DEPARTments of Grand Rapids, Mich., are being given in that city under the auspices of the public library (Samuel H. Ranck, Librarian). The library has issued a circular stating the dates and the names of the lecturers, and giving a brief synopsis of the work of the several departments and their expenditures in the past year. The circular also contains a brief list of books on municipal government.

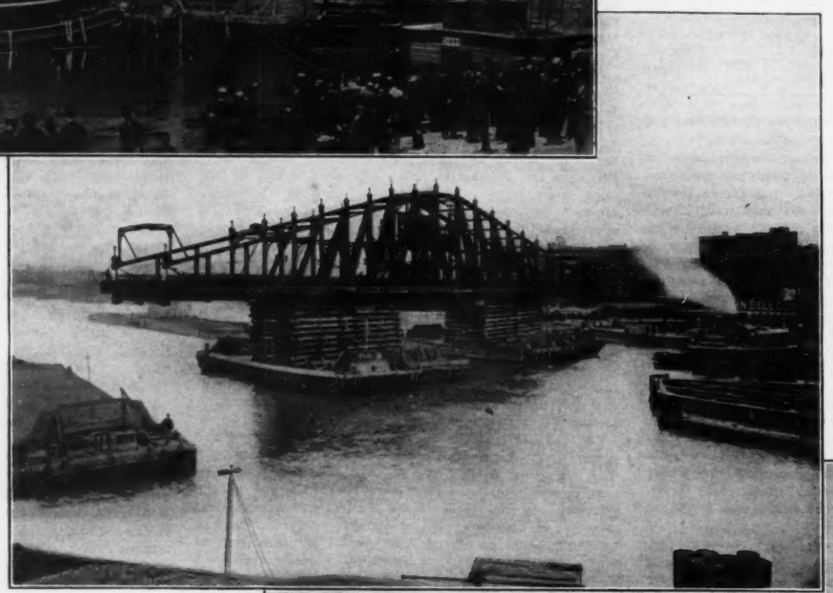
A SWIMMING POOL for the University of Minnesota is being constructed at the joint expense of the Athletic Board of Control and the Board of Regents. The pool will be located in a previously unused and dark basement of the armory, means having been of course taken to provide necessary light, both natural and artificial. The swimming tank will be 25 × 60 ft. in plan, at the usual water depth, ranging from 3 ft. 7 ins. at the shallower end to 7 ft. 7 ins. at the deeper end. It will be possible, by closing the overflow pipes, to increase the depth 12 ins. for aquatic contests. A feature of the tank is an expectorating gutter which extends nearly the full length of the two sides. The gutter will be semicircular in section, 5 ins. in diameter, and will be cut in polished limestone. It will be flush with the usual water surface and will be kept cleansed by the waves that dash over the edge. The interior walls of the swimming tank will be covered with white glazed tile and the floor will be covered with white ceramic tile. The walls and bottom of the tank will be of 1:2:4 concrete, reinforced with ¼ to ⅝-in. steel rods. The aggregate will be graded after analysis, so as to "produce the maximum density and impermeability." In addition, the concrete will be treated with the addition of 2% by weight of Medusa waterproof compound. The tank will be monolithic, as far as possible, on the supposition "that the steel reinforcement will effectually prevent cracks from changes of temperature." The water will be heated by steam injected into it as it flows into the tank. Shower-baths will be provided for use to swimmers prior to entering the tank. The foregoing information is taken from an article by F. H. Constant, Professor of Structural Engineering at the University of Minnesota, which appears in the initial number (November, 1908) of "The Minnesota Engineer."

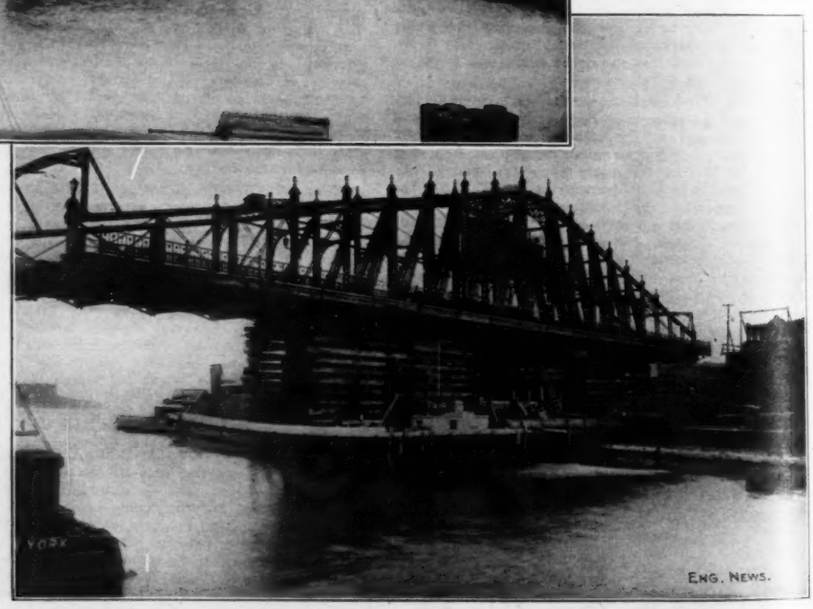
REMOVAL OF MADISON AVENUE DRAWBRIDGE, NEW YORK CITY.

By GEO. H. HEFELE.*

For the construction of a new bridge over the Harlem River at Madison Ave., New York City, it was necessary to divert the street traffic over a temporary bridge about 700 ft. downstream. The plans for the temporary bridge included the use of the existing draw-span, which was to be moved from the old to the new site. It was proposed to lift the entire span, with drum, wheels, pivot-casting, etc., off the old pier, move it integrally to the new site and place it on the pile center pier which had been built for the temporary crossing. This would require a new bottom tread and rack, which would have to be set on the temporary pier in advance, but the span would be ready for immediate operation as soon as it was lowered upon the new pier, so that traffic would be interrupted only during the time needed for the actual moving. The plan naturally involved floating the structure on scows from the old site to the new. The execution of this work, which was accomplished successfully (see the views Figs. 1-3), is described in the following:







FIGS. 1-3. REMOVAL OF MADISON AVENUE BRIDGE, HARLEM RIVER, NEW YORK CITY, TO ANOTHER LOCATION FOR USE AS TEMPORARY BRIDGE.

The structure to be moved was a pin-connected swing-span 300 ft. in length and 40 ft. in width, weighing about 640 tons. The two trusses are 40 ft. deep c. to c. of pins at the tower, but the upper chord slopes downward so as to make the ends of draw only 7 ft. deep c. to c. The under-clearance was about 24 ft. above high water. The compression members consist of latticed channels, with cover plates in the heavier sections, while the tension members are eyebars. The material is wrought-iron.

Many interesting problems presented themselves in preparing the structure for its journey downstream. A detailed survey of the entire span was first made, as no plan of the bridge was obtainable. Because the bridge had been in operation about 25 yrs. every part of the structure was very carefully examined to discover any weakness. In spite of its long service, the bridge was found to be in a remarkable state of preservation. No indication of serious corrosion was observed except in the cover-plates of the transverse loading girders, where dust and dirt, sifting through the flooring, had accumulated and retained moisture.

After the survey was completed, the locations of scows and points of support during the removal were studied. It was found that by using two 30 × 100-ft. scows under each arm, sixteen panel points of the bridge could be supported. The stresses in the trusses for this arrangement (eight points of support under each truss) were calculated, and it was found that considerable reinforcement would be required to provide for the reversal of stresses, particularly in the tension members (see partial stress-sheet, Fig. 4).

Several schemes of reinforcement were considered, but owing to the close packing of members at the pins it was decided that some method of taking the compression directly through the eyebars was most feasible. This was done by clamping full-length timbers along the sides of the eyebars, to stiffen them effectively as lacing (Fig. 5).

No effort was made to have these timbers come to a bearing at the ends, but blocking was inserted at the foot of the timbers as a support to relieve the eyebars of any crossbending. The timbers were clamped at intervals, to bind the reinforced member solidly together and make it act as a whole in resisting buckling. Wooden wedges were driven between eyebars at the clamps to pack them solid. The timber clamps consisted of ¾-in. plate washers, one on each side of a set of timbers, connected by either two or four 1-in. bolts. The clamps with two bolts were placed at distances apart equal to about one-half the calculated column length required to make the eyebar in the direction of its thickness stiff enough to take the calculated stress. The clamps with four bolts, which carried also a bolt with washers tying the members together in the direction of the width of the bar, were spaced at intervals of about half the column length corresponding to the width of the bars.

The maximum compression which the eyebars would be subjected to was about 7,000 lbs. per sq. in., in a single panel. This stress, however, was accidentally increased during the process of lifting to about 9,000 lbs. per sq. in. owing to the accidental binding of the pivot casting, which was great enough to rupture five 1-in. bolts. The effect of this stress on the eyebars, which acted as columns of lengths varying from 30 to 43 ft., was closely watched by the writer. Not the slightest sign of bending or displacement of reinforcement was observable. In fact the wedges at the foot of some long timbers could be withdrawn by hand while the bridge was

*Engineer for Lawler Bros. Construction Co., Contractors.

suspended. The wooden wedges at the clamps gave no indication of distress. The reinforcement in the top chord followed the same scheme as that of the eyebars in the web system.

The posts that were in tension during the removal were found to be of more than ample section except at the pin connections to the bottom chord, where the posts extended but 2¾ ins. beyond the pin. The values for bearing and shear were within reasonable limits of safety, but considering the portion of post beyond the pin as a beam, of length equal to the diameter of pin and uniformly loaded, it was found that the fiber-stress ran as high as 37,000 lbs. per sq. in., which would probably result in splitting the post. To strengthen this weak point, part of the tension in the post was transferred by a direct connection of 4 × 4 × ⅜-in. angles between the batten-plates of the post and the side-plates of the bottom chord, the latter transferring the tension to the pin (see detail in Fig. 6).

The bottom chord also was found to be sufficiently strong for tension, except at the four adjustment joints which occur in the panels adjoining the tower. These joints consisted of two castings, face to face, of varying thicknesses, which were practically cast-iron shoes, fastened to the chord by very light connections; they could not be used in tension. A tension splice was therefore made at these joints by riveting cover-plates across the flanges of the chord at either side of the castings, and riveting over them longitudinal splice-plates which cleared the top and bottom of the castings.

For the support of loading girders, drum, wheels and pivot casting, no direct connection with the tower posts was feasible, as these merely bore on base-plates resting on the cover-plates of the loading girders, which were of box section. Therefore 18-in. 60-lb. I-beams were riveted to the batten-plates of adjacent posts, and the loading girders were suspended from them by means of 1¼-in. bolts running to their underside. The loading girders in turn held up the drum by means of 1½-in. bolts at the points where their flanges crossed. The wheels were supported from the drum on the outside by means of special ¾-in. bolts formed with a hook on the lower end to engage the spacing-ring, at every fourth wheel, the upper end of the bolt having an eye which fitted over the bolts fastening the upper tread to flanges of drum. The wheels were also supported inside of the drum, by means of timbers resting on the bottom flange as chords of a circle, through which ran bolts carrying a corresponding stick engaging the underside of the radial rods.

The pivot casting was of great weight. To carry it, five 1-in. bolts were provided, supported at their upper ends by the floor stringers and at the bottom screwed into 1-in. tapped holes in the pivot-casting. The casting was also firmly braced to the drum by four 6 × 6-in. radial struts, so as to make the entire underbody of the bridge act as one rigid piece. Much dependence was placed on this to hold the bridge in position while raising and lowering.

Particular attention was given to the blocking on the scows. The scows were lashed together side by side, in pairs, one in advance of the other to conform to the skew of the bridge when lifting. Timbers were spaced on the decks of scows to distribute load, and a crib of square timber was then built on the scows to the required height, no spikes or fastenings being used. Some of the transverse timbers of the crib work connected both scows. No bulkheads or braces were placed below decks.

In preparing to move the bridge, the draw was swung around far enough to clear the approach spans at each end. The scows were towed in place at low tide, two under each arm, and securely fastened to the fenders of the bridge. Men started blocking up between the cribs and bottom chord of bridge at the panel points, the steel bearing directly on the timber. After the blocking was completed the pivot casting and wheels were hooked up. The bridge was then lifted by the rising tide. The main pinions at the rack were not disconnected and they helped relieve the strain on the pivot casting caused by the current in the river acting on the scows.

In lifting, it developed that the pivot casting was seated much more firmly than expected, and the five 1-in. bolts, which were to raise it, broke without disengaging the casting from the pier. They were soon replaced, and by prying the casting was loosened enough to enable the bolts to lift the casting free on the next trial. Sufficient delay was caused by the accident to make it necessary to wait for the next tide. While the bolts were being replaced, the scows were pumped down to keep the bridge from lifting off.

After the bridge was lifted high enough and had cleared the bottom tread by about 14 ins., the scows with their load were towed downstream by two powerful tugs, one pulling ahead,

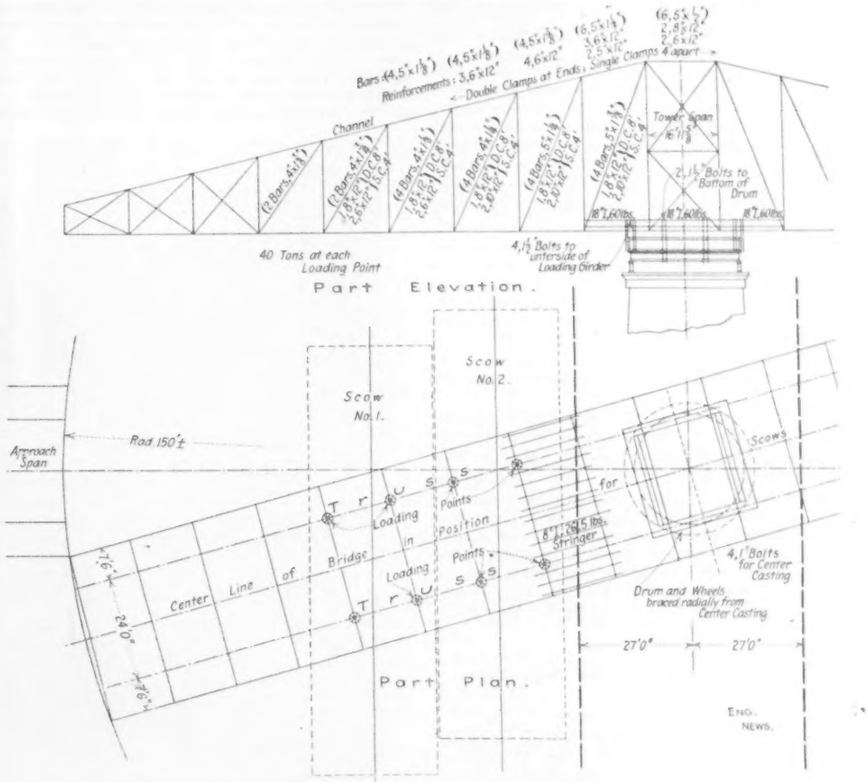


FIG. 5. GENERAL PLAN OF REINFORCEMENT.

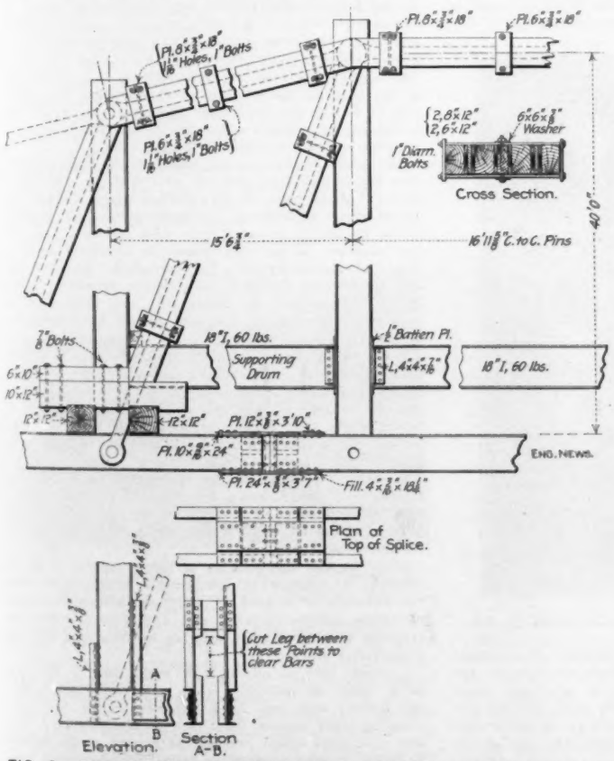


FIG. 6. DETAILS OF REINFORCEMENT OF EYEBAR MEMBERS, AND SUSPENSION ARRANGEMENT FOR TURNTABLE.

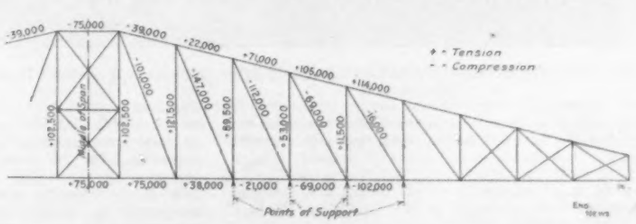


FIG. 4. STRESSES IN EYEBAR MEMBERS, BRIDGE ON SCOWS.

the other in the rear to retard progress if necessary. The passage downstream took about 25 mins.

When the bridge was safely located over the new pier, the scows were slowly settled by pumps from the tugboats. To center the bridge accurately, holes had been previously bored in the new pier to conform to the position of the bridge, and tapered bolts 2⅛ ins. in diameter were placed in the holes to engage the bolt-holes of pivot casting. The bridge was gradually wormed into place, until the bolts on the pier entered the holes in the casting. The rack pinions, engaging the new rack, were also of great assistance in centering the bridge.

No difficulty was experienced in centering the structure on the new pier. As soon as the bridge was lowered and the scows withdrawn, it was turned by its own power, the mesh of pinions and rack being practically uniform throughout.

The reinforcement described required 28,000 ft. B. M. of timber. As very little cutting was necessary and there were no bolt-holes in the large sticks, the salvage value was nearly 100%.

The contractor for this work was the Lawler Bros. Construction Co., of New York. The reinforcement and scheme of operations were designed by the writer as engineer for the contractor. Mr. W. J. Lawler personally superintended the moving. The work was done under the direction of the Department of Bridges, New York City.

WOOD PRESERVATION BY THE OPEN TANK PROCESS.

By ERNEST F. HARTMANN.†

Any discussion of the subject of wood preservation ordinarily begins with the causes of decay. This paper, however, is not concerned with the causes of decay but with its prevention. Rot and decay are factors which must be taken into consideration by every engineer contemplating the use of timber for any construction work. Wood preservation aims to preserve wood against premature decay. It goes further, however, for to-day its principal object is to make the short-lived and less durable varieties outlive the untreated long-lived species.

Applying the old adage that "an ounce of prevention is worth a pound of cure" to the subject of wood preservation, it should be borne in mind that low forms of vegetation facilitate the decay of timber. Inferior ballast, and particularly material like sand which will not dry out readily, is very injurious to the life of timber. Permitting decayed ties to remain on the right-of-way after they have been removed from the track is a very prolific source of decay. They should be burned to prevent their disseminating spores of fungus.

Although a digression from the subject, the following may be of interest as an illustration of what can be accomplished with timber often considered waste. Until recently mining companies used broken gangway timbers and other waste only for fuel. At this time the Philadelphia & Reading Coal & Iron Co. has installed 12 saws at their different collieries which cut up these broken timbers into slabs of sufficient length to be used for roofing, and this innovation is resulting in a profit to the company of nearly $3,000 per month. Other coal companies are following this example.

The initial step to secure longer life of timber is to use only such as has been properly seasoned. Air-seasoned timber is stronger, more durable and less subject to checking and splitting than green timber, and most woods recommended for treatment are also open grained, and being more porous, can be air seasoned by proper piling in comparatively short periods. Air drying means reducing the moisture contents of the wood to about 20%, thus 80% of that which promotes the life of decay germs is removed from the wood by proper seasoning. The risk taken when timber is held for air-seasoning as well as the interest charge on the investment is inconsiderable when compared with the saving represented by the increased durability and longer service of such timber. In Europe all timber, whether to be treated or not, is fully air-seasoned before use.

Too much stress cannot be laid upon the proper piling and seasoning of timber. Timber should always be piled so as to take advantage of all prevailing winds, taking into consideration, the particular climatic conditions of the respective locality so as to prevent too-rapid drying and consequent checking and splitting.

The open tank method has developed a new form of seasoning which eliminates the use of comparatively green timber by immersing it in a bath of oil heated above the boiling point of water and this is now becoming known as oil seasoning. An explanation of this will be given a little later. Where possible, it is advisable to use air-seasoned timber when employing the open tank process, because it will require a much shorter immersion in hot oil to drive off the sap and water.

Regarding the best preservative to use, there are various qualifications to be taken into consideration. Tar oils are to-day more widely used as preservatives than any other material, because of the good results obtained by their use.

It can be stated as a fact that it is the high boiling constituents of coal tar that remain in the wood and act as the preservative. It has been definitely ascertained that the lighter and more volatile oils disappear from the wood entirely within four years on timber fully exposed to the air. Similar results were obtained on poles at the ground line, and ties have also been examined with practically the same results. The only exception has been piling, submerged in water, and even here the high boiling oils were the principal factors that prevented decay. The amount of penetration or rather the quantity of oil injected should for these reasons be no criterion on the assumed added life of the timber, without considering the character of the oil used.

The results of analyses and examinations made on timbers which had been perfectly preserved for periods of from 16 to 32 years should convince every engineer of the necessity of definitely ascertaining the exact quality of the oil that is intended to be used for wood preserving purposes. At no time should the antiseptic requirements of the preservative be overlooked. These disinfecting elements should be of a nature permitting them to so combine with the heavy oils, that they may be rendered non-volatile; the two should be chemically united.

When using the open-tank method where it is necessary to hold the temperature above the boiling point of water, it is advisable to use a preservative containing few or none of the light oils, for when treating at temperatures only slightly above the boiling point of water, the ordinary commercial creosote will readily begin to volatilize.

The best preservatives for application in a concentrated form are obtained by the redistillation of tar oils by accurately gaged temperatures to secure that portion of the oil which exerts the greatest amount of protective action.

While for ties the question of inflammability is of no concern, it becomes of considerable importance when the preservative is used on buildings, bridges, trestles, platforms, under-structures, etc., and must therefore be carefully considered when drawing specifications for the preservative oil.

I believe that at all times it would pay to dip the bolts, spikes or nails in a good preservative before being driven, and thus in a measure protect the surrounding wood against the attack of fungus. This will also to a large extent prevent the rusting of the spikes or bolts, thereby causing them to hold better in the wood.

The open-tank process and the brush method of treat-

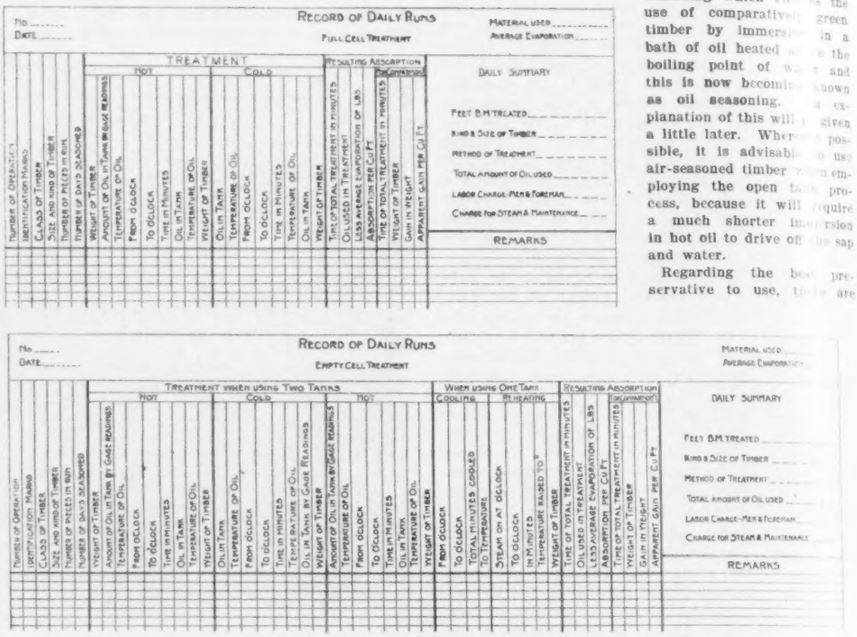


FIG. 1. RECORD FORMS FOR THE OPEN-TANK PROCESSES OF TREATING TIMBER.

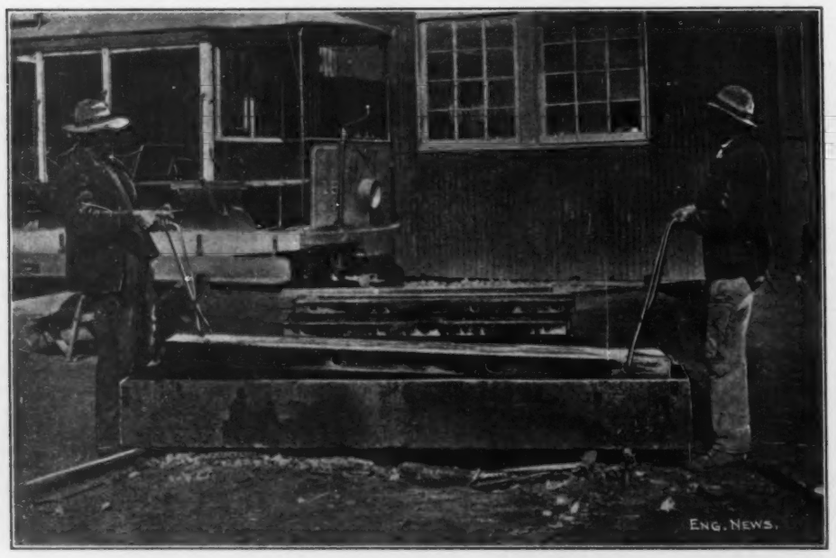


FIG. 2. OPEN-TANK TREATMENT OF CROSS ARMS, COLUMBUS R. R. CO., COLUMBUS, GA.

*Part of a paper before the convention of the Association Railway Superintendents of Bridges and Buildings, Washington, D. C., Oct. 21 to 23. Copyrighted by E. F. Hartmann. Rights reserved.

†President, Carbolineum Wood Preserving Co. of New York, 351 West Broadway, New York City.

ment can be adapted to all preservative requirements. Thus timber can be locally treated to be preserved at points where decay is most likely to set in. As a process the open-tank method has a great advantage over the vacuum method in its adaptability to different forms of treatment. The penetration can be regulated with far more certainty than by any other method, and preparing these charts it has been my endeavor to cover all steps necessary to secure the most accurate results possible, the object being primarily to give a basis for a form of sufficiently complete record of all treatments. Many of the subdivisions will undoubtedly be eliminated in actual practice, but they are presented for the purpose of enabling every engineer to arrive

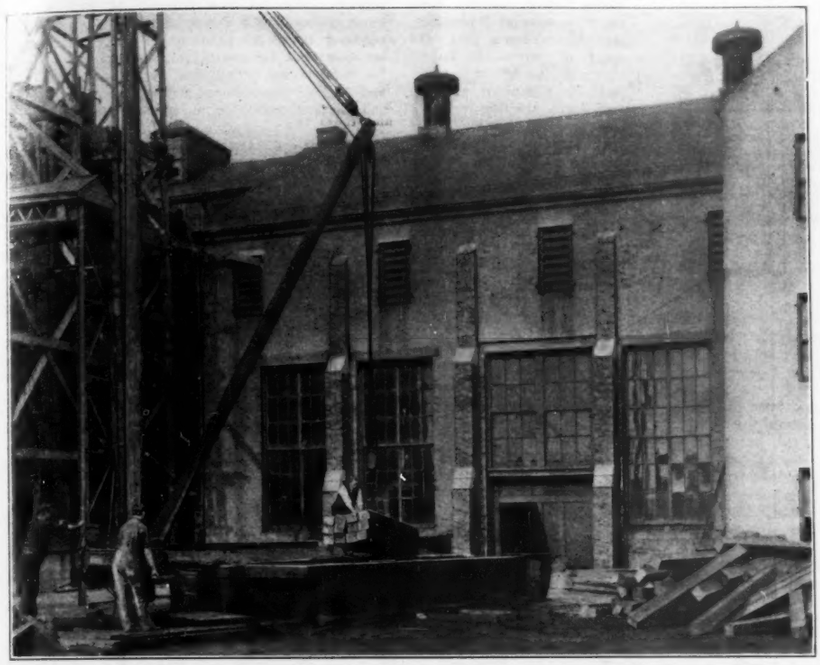


FIG. 3. OPEN PRESERVING TANKS OF THE BOSTON ELEVATED RY. CO.

thereby an excessive and unnecessarily heavy injection can be prevented.

It is now well settled that the action of wood destroying agencies is mainly from the outside, and to this fact are ascribed the efficiency of certain preservatives which merely form a superficial coating over the surface of the timber. This is because such preservatives are poisonous enough toward fungi spores to prevent them from developing on timber so treated and from entering into the untreated interior wood.

If, then, the timber is in proper condition to receive treatment, or has been sufficiently seasoned while in the hot oil bath, the penetration need not be very deep providing the preservative injected can prevent spores of fungi from obtaining any foothold and is stable enough to remain in the wood until the mechanical life of the timber is gone.

Briefly stated, the process is as follows: As the timber is immersed in a bath of preservative heated to a temperature above the boiling point of water, the air in the wood cells expands and the sap or moisture contained in the wood evaporates in proportion to the

Fig. 4. An Early Preserving Tank, Norfolk & Portsmouth Traction Co., Norfolk, Va.

duration of the hot bath and also the temperature of same. The timber is then plunged into cold oil, which causes the air remaining in the wood to contract, forming a partial vacuum. To satisfy this vacuum, the oil is drawn deeply into the wood.*

From Fig. 1 a fair idea of both the full and empty-cell method of treatment can be obtained. In

*[For a more extended discussion of the theory of the open-tank processes see a paper by Mr. H. F. Weiss in Engineering News, Oct. 22, 1908.—Ed.]

definitely at the cost of treatment as well as the resulting absorption.

The form of record sheet for the empty cell treatment is subject to such changes as may be called for by conditions. At all events, only a part of this record sheet would be used, for the treatment would either be with alternate hot, cold and hot immersions and then would follow the summary, or it would be heating, cooling and reheating in a single tank. In this latter method the retreating in hot oil or reheating of the oil causes a diffusion of the oil through a greater area without the use of any additional preservative.

The ordinary method of computing the absorption is to weigh the timber both before and after treatment. This, however, is very unfair when the theory of this process is borne in mind. Even room-dry timber contains 10% of water and this must be considered.

Actual absorption is obtained better by computing the oil used in treating less the average evaporation for the same period of time, and dividing actual amount of oil used by the cubic feet of timber treated, but even this is not accurate unless the readings are taken at the same temperature.

The success of treating merely in hot oil can be largely ascribed to the removal of the sap and water from the timber by this form of treatment, which, while not giving a heavy penetration, insures the preservative reaching all cracks, checks or splits already in the timber, and again for the reason already stated, that a superficial treatment with a sufficiently antiseptic oil will prevent decay germs from developing.

A brief reference to brush treatment should come at this time. It is of great value when no other method can be used, as for instance in treating the cut ends of timbers, joints, mortises, points of contact, etc. Again for structures already erected it is much more reasonable to apply a coating of a good preservative than a coating of oil paint.

In the treating outfits which are now to be illustrated, steam is always used for heating the preservative unless otherwise stated.

The first open tank used by any railway company of which I have been able to obtain some definite record was that of the Columbus (Ga.) Railroad Co., which in 1891 commenced the treatment of their ties. The oil was heated in a tank shown in Fig. 2 by means of a wood fire, old ties and waste being utilized for fuel. Crossarms have also been treated in considerable quantities for the Columbus Power Co. The cost of such a treating outfit is very small. It holds two ties at a time, which are immersed in the oil for ten minutes. They are then thrown upon an iron dripping plate after which they are piled to dry before receiving the second treatment, care being taken in the second dip that the timber is completely submerged and immediately removed. After draining they are stacked ready for use. The former manager of this company advises that the complete cost of treatment per tie was 31 cts., making a total cost of $9.68 per M. ft. B. M.

The Boston Elevated Railway Co. in 1897 began the treatment of ties and are now using the treating plant shown in Fig. 3. They have treated approximately 90,000 ties, including tamarack, chestnut, oak and hard pine, 7 ft. × 8 × 6 ins., and the treatment has cost them from 15 to 17 cts. per tie, making a cost of $5.71 per M. ft. B. M. This tank is 18 ft. long, 4 ft. wide and 5 ft. deep, made of ⅝-in. boiler plate. A 1½-in. steam coil is used. Bundles of 10 or 20 ties are handled by the derrick shown in the picture, the capacity of the plant being from 600 to 800 ties per day. Mr. A. L. Plimpton, their civil engineer writes:

> We do know that it greatly prolongs the life of the ties. In our reservation tracks where part of the ties have been treated, when it was necessary to renew the rail we were able to use over again the ties that had been treated, while those that were untreated, were not fit to remain.

Fig. 4 represents the first tank installed by the Norfolk & Portsmouth Traction Co., Norfolk, Va., on which cross timbers were used to hold down the ties. A conveyor chain arrangement has now been worked out by the engineers of this company. The tank, which is 30 ft. long, 10 ft. wide and 24 ins. deep, is made of ¼-in. steel plate with 2½-in. angle-iron corners, and cost $300 (f. o. b. Norfolk). The conveyor chains cost $450, and the capacity of a plant so arranged is 1,000 ties per day. By using removable rails to hold down the ties, this tank can be used for bridge and trestle timbers. The cost of treatment, including labor, steam, etc., was 23 cts. per tie, making a total cost of $7.20 per M. ft. B. M.

Fig. 5 shows a double tank equipment, for treating cross-arms erected by the Southern Power Co., of Charlotte, N. C., under the direction of Mr. L. W. Frazer, Assistant Chief Engineer. The inner tank is 4 × 8 × 3 ft., and is surrounded by a second tank 5 × 9 ft. and 4 ft. deep, filled with water heated by a steam pipe from a boiler set up for other purposes. Both tanks are made of 3/16-in. steel plate and stiffened around top and bottom with 2-in. angle irons. The cross-arms are 4¾ × 5¾ ins., 7 ft. long. They are treated for 15 minutes in oil at a temperature of 65° C. and absorb from 3 to 6 lbs. of oil.

For Fig. 6 I am indebted to Mr. J. W. Cartwright, Jr., Treasurer of the Bangor Railway & Electric Co. This concern has treated some 8,000 spruce cross-arms in this tank. The cost of the treatment, including the price of the galvanized-iron lined tank, 12 ft. square and 3 ft. deep, was 12¾ cts. for a 10-ft. cross-arm, or a cost of $7.66 per M. ft. B. M. The cross-arms are placed in the tank until no more will float and they are left ten minutes in the hot oil, after which they are placed on the draining table shown.

Fig. 7 shows an open tank in use at English mines for treatment of mine props. Treatment lasts from

Fig. 5. Double Open Tank, Southern Power Co., Charlotte, N. C.

ten minutes to half an hour, the oil being heated to 100° C. The first plant of this kind was installed in England in 1901.

The Consolidated Coal Co., of Saginaw, Mich., use an open tank in which they have treated props and timbers for the entries and buildings during the past five years. As stated by their general manager:

The expense of retimbering under the union scale of wages in the mines is very large, and therefore we feel it is economical to treat the timber and we have treated on idle days with men whom we were obliged to have around the mines. Timbers treated have never shown any signs of rot so far, while untreated timber has to be replaced in from one to two years.

In the tank shown in Fig. 14 the Peerless Motor Car Co., of Cleveland, Ohio, treated 150,000 ft. of flooring,

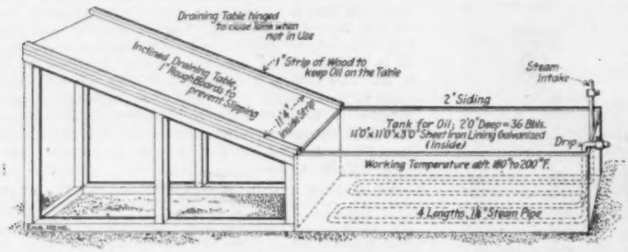

Draining Table hinged to close form when not in Use
Inclined Draining Table 1" Roughboards to prevent Slipping
1" Strip of Wood to keep Oil on the Table
1 1/4" Pipe Rail
Steam Intake
2" Siding
Tank for Oil, 2'0" Deep = 36 Bbls. 11'0" x 110" x 3'0" Sheet Iron Lining Galvanized (Inside)
Drip
Working Temperature abt. 180 to 200° F.
4 Lengths 1 1/2" Steam Pipe

FIG. 6. TANK AND DRAINING TABLE, PRESERVING PLANT OF THE BANGOR RY. & ELECTRIC CO., BANGOR, ME.

sills and joists during the last three years, at a cost for treatment of $9 per 1,000 ft. B. M. This tank cost $30. It is 20 × 3 × 3 ft., is lined with galvanized iron and has 1¼-in. pipes lengthwise for heating the oil. The Automatic Shovel Co., of Lorain, Ohio, two years ago built a tank at a cost of $5, in which they treated 45,000 ft. of 2-in. plank at a cost for treatment of $9 per M. ft. B. M.

Westinghouse, Church, Kerr & Co. treated by the open-tank method all the flooring, sills and joists used in the construction of the extensive buildings for the Railway Equipment Co., of Chicago. A portable plant was rigged up, the tank being 21 ft. long, so as to enable the treatment of the longest timbers.

Tanks of this kind were first used in 1890 for treating the paving blocks laid on Trafalgar Square, London. The blocks for Northumberland Ave., Charing Cross and many other streets of the west end of London were treated with a similar outfit. The tank itself is 4 × 4 × 4 ft. Blocks are 9 × 5 × 3 ins., and 1,000 of them absorb 10 gals. of the preservative.

Fig. 8 illustrates a block-preserving plant using hot and cold treatment, the blocks absorbing 27 gals. per M. ft. B. M. The hot tank was a square roofing-tar kettle, with a capacity of 200 blocks, 3 × 3 × 8 ins. Old ties were used as fuel to heat the oil. The city of Cleveland installed the treating outfit shown in Fig. 9, which complete with steam pipes, etc., cost $125. At the present time pine plank and 5-in. blocks for paving the Abbey St. viaduct are being treated in this tank. The cost is $2 per M. ft. B. M. for handling the lumber, and they are using 10 gals. of oil per M. ft. B. M. for the plank and from 12 to 15 gals. for the blocks. The tank is 4 × 6 × 25 ft. They use a 15-HP. boiler, the oil being heated to 220° F.

Treated flooring is particularly adapted for shops, freight and round houses and a good deal has been laid by the Southern Pacific Ry., Oregon R. R. & Navigation Co., and other railroads in the Northwest.

The first experimental plant was erected by the U. S. Forest Service in 1906, cooperating with the Philadelphia & Reading Coal & Iron Co. This company being convinced of the value of the treatment has erected a complete plant similar to that of the Delaware, Lackawanna & Western R. R. at the Auchincloss Mines (Fig. 10). This treating plant, near Nanticoke, Pa., has just been placed in commission. The cost of this plant to the company, including all piping, tracks, engines, etc., was about $5,000. The storage tank has a capacity of 21,000 gals. and the receiving tank, the cover of which is barely shown on the left of the picture, has a capacity of 9,000 gals. The treating cylinder requires 3,000 gals. when the timber is in place for treating. The dome on the cylinder is to relieve the pressure when the oil is heated and from this dome the volatilized oil is piped to the receiving tank, the oil running from the storage tank to the treating tank, and from there to the receiving tank by gravity. The daily capacity of this plant is 4,800 ft. B. M.

The plant at Scranton, shown in Fig. 11, is also owned by the Delaware, Lackawanna & Western R. R. and is used for the treatment of mine ties as well as mine props. The method of handling the timber is here well illustrated.

In the wooden tank, shown in Fig. 12, were treated the flooring, sills and joists for the new No. 8 Pier of the Baltimore & Ohio R. R., at Baltimore, the timber receiving a 15-minute immersion in the hot oil. All the dock floors, sills and joists for the immense docks erected by the Northern Pacific Ry. Co., at Seattle, Wash., were treated in a similar manner. The Minneapolis & St. Louis R. R. Co. treated bridge ties by the open-tank method using a steel tank 14 × 3 ft. and 2½ ft. deep, with live steam pipes through the bottom of the tank. The ties were handled with timber hooks. The total cost of treatment per M. ft. B. M. was $9.81, including cost of tank and labor.

Fig. 13 shows a tank 40 ft. long, 3 ft. wide and 4 ft. deep, with steam pipes in the bottom. In same, the Milwaukee Car Mfg. Co. is treating car sills, etc. The crane used is worked by compressed air. The timber is treated for fifteen minutes, after which it is placed on a draining platform.

In 1900 the Ruemmeli-Dawley Mfg. Co., at St. Louis, erected a tank of wood lined with galvanized iron. Steam is used to heat the oil. The tank has been variously used for the treatment of timbers for the [illegible] water-works and considerable quantities of string[illegible] flooring, etc., particularly the lumber used for the [illegible]struction of water cooling towers. At this plant [illegible]arge for treatment is made of $10 per M. ft. B. M.

A treating plant for round and [illegible] piling was erected at Slidell, La., by Jame[illegible] Stewart & Co., under the supervision of the [illegible] S. Engineers Office, of New Orleans, in 1897. [illegible] tanks were equipped with steam coils for heating [illegible] oil and conveyor chains for handling the piling. At [illegible]ll, La., an open tank for treating cross-arms has be[illegible] operated for many years. This tank is 36 ft. long, [illegible] ft. wide and 18 ins. deep. Heart yellow pine arms w[illegible] treated and these absorbed on an average 10 gals. [illegible] M. ft. B. M.

Various U. S. Army Engineers have used the open-tank method on work mostly in the Mississippi River valley and on the Pacific coast. During the past four years a tank, 30 × 3 ft × 18 ins., fitted with a cover and steam pipes has been used at St. Louis by the U. S. Army Engineers. The superintendent of the U. S. Engineer's office, at Columbus, Ga., who has treated yellow pine timbers for barges and tow boats, advises that the cost of treatment for labor is about the same as if painted with ordinary paint. He gave a treatment of 125 lbs. of preservative per M. ft. B. M., leaving the timber in the tank for from 20 to 40 minutes, according to its size. The result of the treatment was so satisfactory that a larger plant is being built for future use.

The treating tank of the Denver City Tramway Co. is 15 ft. long, 7 ft. wide and 2½ ft. deep, and is made of 3/16-in. boiler plate. The draining table is 16 ft. long. The oil is heated by keeping a slow fire under the tank.

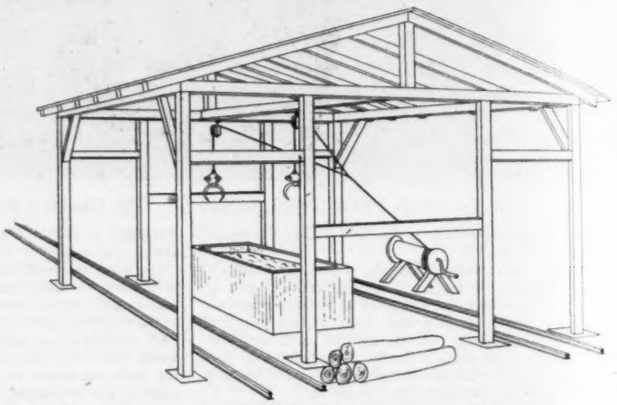


FIG. 7. A TANK FOR TREATING FLOORING, SILLS AND JOISTS.

About 10½ gals. of oil are used per M. ft. B. M. when the ties are thoroughly seasoned. At this plant 5,200,000 ft. B. M. of yellow pine have been treated since 1904, at a cost of from 16 to 18 cts. per tie. The charge per M. ft. B. M. including all labor of tearing down tie pile, treating and repiling is $6.63. The labor is all hand work, a small crane being used to assist in piling the ties. The chief engineer, who furnished this information, estimated ten years additional life of the ties. Oregon poles are treated by the brush method 12 ins. above and 12 ins. below the ground line.

The Utah Light & Railway Co., of Salt Lake City, who have used approximately 150,000 Oregon fir ties treated by this method during the past seven years, estimate the cost of treatment to be about 28 cts. each, or $8.68 per M. ft. B. M. The resulting life of a treated tie was estimated by Mr. J. S. Wells, General Manager of the company, as 15 years, the ties showing no deterioration after having been in the track for seven years.

At Portland, Oregon, a company has been operating open tanks for the past seven years. They now have five treating plants in operation, one near Seattle, Wash., which is supplying the Stone and Webster properties in that vicinity. The standard form of treatment given Oregon fir is 100 lbs. per M. ft. B. M., equivalent to about 12 gals. A charge of $10 per M. ft. B. M. is made for the treatment. Ties have been treated in considerable quantities for various street railway and railroad properties on the Pacific coast. This, I believe, is the first wood-preserving company employing open tanks for the treatment of ties, timber and paving blocks.

Taking as a basis the exact cost figures given by engineers operating open tanks, the average cost of treatment per M. ft. B. M. is $8.33⅓, thus proving that the simplicity of the open-tank method has considerable bearing on the cost of treatment.

These several installations are cited to demonstrate the feasibility as well as practicability of this method of treatment for companies both large and small.

FIG. 8. A SMALL AND INEXPENSIVE PAVEMENT-BLOCK PRESERVING PLANT.

THE USE OF THE MOTOR OMNIBUS IN EUROPE.

The motor omnibus as a regular system of transportation has not come into such extensive use in this country as in Europe. In Europe the motor omnibus is employed in different classes of service, which may be grouped as follows: (1) city and suburban; (2) railway feeders, the cars being owned by railway companies and run to villages or summer resorts at some distance from the railway stations; (3) independent interurban lines in districts which have no railway communication. An interesting report on this subject was presented at the Congress of the International Union of Street Railways and Light Railways, held at Munich in September. This report was prepared by Mr. Mauclere, Superintendent of the General Omnibus Co., of Paris. It dealt mainly with the service on country roads, and from it we have prepared the information given herewith.

This system of transportation has been in regular use for about four years. The principal development has been in London, where there are now over 1,000 motor omnibuses. In Paris there are 150, and in Berlin 60 cars. The London cars are not included in the particulars given below, which relate to the equipment of 15 companies in various cities and country districts.

Double-deck omnibuses are used only in a few cases. These carry from 32 to 37 passengers. The ordinary cars used by other companies carry from 10 to 32 passengers each. The use of longitudinal and transverse seats is about equal. In several cases, the total dimensions of the seats are prescribed by municipal regulations. One company has 150 cars, another has 60 and the others have from one to five each. The number held in reserve varies from 20% (upward) of the total number. The length of run is from 3 to 4 miles on city routes, and from 1½ to 10 miles for feeder lines, while for interurban lines it is from 15 to 33 miles. The mileage per car per day is from 60 to 90 miles, but in one case 115 miles.

The speeds vary from 6 to 10 mi. per hr. for city lines, and from 10 to 15 mi. per hr. for the other lines. Two city lines have grades from 7 to 8%, and one interurban line in a mountainous district has grades of from 3% to 7%. In most cases the cars operate on macadamized or paved roads, but the roads are not always kept in good condition. In some cases, the companies pay a tax (or a proportion of the receipts) for the street or road maintenance expenses.

The majority of the omnibuses are equipped with engines of the internal-combustion type, using gasoline as fuel. Two companies use steam cars of the Darracq-Serpollet type. One uses a gasoline engine in combination with an electric generator and motor, and one company uses the "trackless trolley." This last-named system is suggested as offering opportunities for lines operating in connection with electric railways. The motors used range from 18 HP. to 40 HP. The transmission of power to the axles is more frequently by means of chains than by gearing. Most of the companies have buildings where the cars are cleaned, repaired and stored; and most of them also maintain fuel storage. The cars are lighted by electricity, or by acetylene or gasoline lamps. The weights and other particulars of some of these motor omnibuses are given in the accompanying table.

The tires are a very important feature of the equipment. One company uses pneumatic tires, as its cars are very light (10 to 12 passengers). All the others use plain tires, which are generally double on the wide rear wheels. Two companies have replaced rubber tires on the rear wheels with the Chary anti-skidding tires having rows of blocks. With these exceptions, however, little attention appears to be given to the matter of skidding (or side slip) which is so serious in city streets. At Berlin, an iron rim is placed between the two tires of each rear wheel in order to prevent this side slip. The manufacturers guarantee the pneumatic tires for 2,480 miles, and the plain tires for from 5,600 to 9,400 miles. Apart from the quality of the material, the life depends upon the weight carried, the speed of travel, and the condition of the roads. Frequent stopping, starting and changing of speed tend to decrease the life of the tires. As a rule, the tires last for the guaranteed mileage.

The greatest development has been in London, as already noted. This is due to the following conditions: (1) the city has the most extensive omnibus service in the world; (2) there is no restriction upon the establishment of such service except that it must comply with police regulations; (3) the old laws governing the use of mechanically operated conveyances (which imposed prohibitive limitations as to weight, size and speed) were superseded by a more liberal law in 1904. This limits the weight to 5 tons (empty), the width over wheels to 6½ ft., and the speed to 12 mi. per hr. The streets are clean and well kept, the grades are easy, the cost of gasoline is very low, and the cost for tires and their maintenance is low also. The only obstacle to a rapid development of the system was the difficulty in promptly obtaining the requisite number of cars, and this explains the great variety of systems now in use in that city. In the spring of 1908 there were 13 companies, and the six largest companies had 1,017 omnibuses in use in the city and suburbs. Of these, 972 had gasoline engines, 34 had steam engines, and 11 had electric storage batteries.

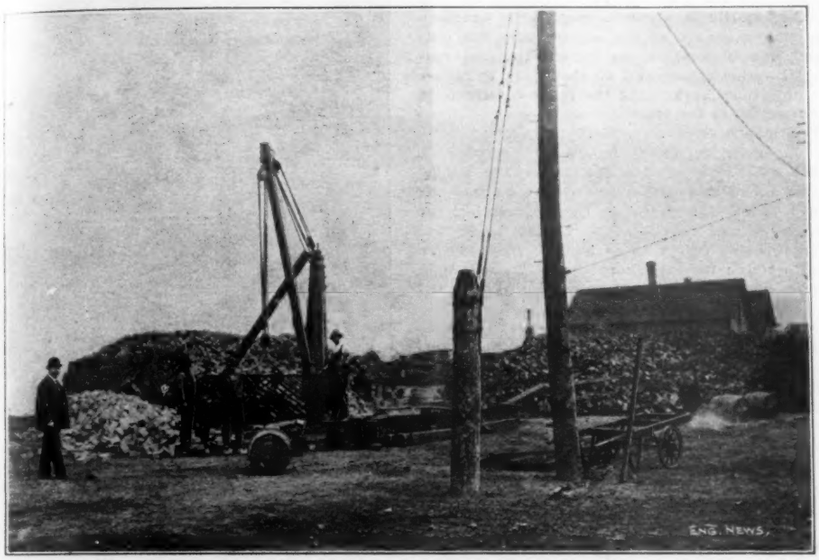


FIG. 9. BLOCK AND PLANK OUTFIT, CITY OF CLEVELAND, OHIO.

Fig. 10. Auchincloss Mine.

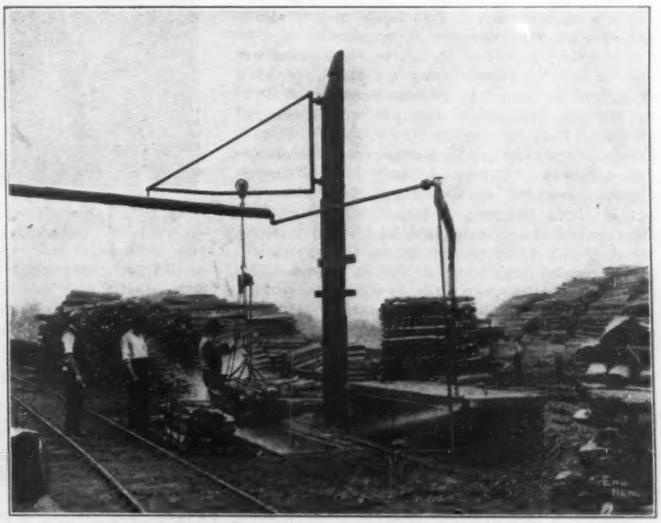


Fig. 11. Bellevue Mine.

FIGS. 10 AND 11. PLANTS OF THE DELAWARE, LACKAWANNA & WESTERN R. R., FOR PRESERVING MINE TIMBERS.

In Paris, the substitution of mechanical power for animal traction of omnibuses has been much less rapid, partly due to the heavier grades (from 7 to 8%), but largely to the higher cost of gasoline on account of the duty imposed. The cost is three times the London cost. The first motor omnibus line was started in 1906, and in June, 1908, there were seven lines operated by 150 omnibuses (103 in service and the others in reserve). The city requires a certain number

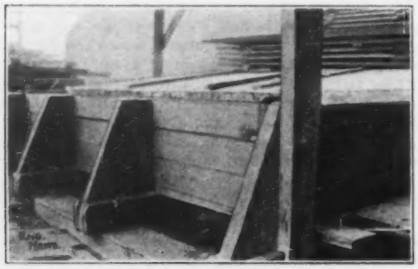


Fig. 12. Open Tank for Treating Flooring.
(Baltimore & Ohio R. R.)

of trips per day, and the total daily run aggregates about 8,500 miles. For each line there are always two cars in reserve, to take the place of any that may break down or meet with accident. With these, and with the cars under inspection or repair, the number of cars in reserve is about 40% of the total equipment. All the cars have gasoline engines of 35 to 40 HP. In the country districts of France there are several motor omnibus lines which are of great utility.

In towns having street railways, a motor omnibus service may serve as feeders and extensions until such time as the traffic warrants the expense of building tracks on these routes. Where there are no tramways, an omnibus service will be of great value when the traffic and receipts are sufficient to warrant its introduction. Many railway companies (especially in England) have found it of advantage to operate a service of this kind between stations and neighboring towns and villages. Districts where railways have not been developed may be served by a similar service (operated independently of railways or connecting with the nearest stations). Motor omnibuses may also be used for summer routes and for excursions. In each of these different cases, it is necessary to select the most suitable type of car, and to make proper allowance for maintenance and repair cost.

For cities, cars seating 30 to 36 persons are recommended. Larger cars are too heavy and slow. These cars will require engines of 30 to 40 HP., according to the rate and length of grades. For railway-feeder routes, the cars should carry 10 to 12 passengers. For interurban routes, they should carry 14 to 20 passengers. In both of the latter cases the cars should carry baggage and parcels. Cars operating outside of cities should be able to attain a speed of 15½ to 20 mi. an hr. on the open road, police regulations reducing this in towns. The weight should be about 5,000 to 6,500 lbs. empty; the live load may be estimated at 150 lbs. per passenger, or 200 lbs. including baggage. A car of this kind would have an engine of about 20 HP. The cars should be substantially built, for while this may slightly increase the weight, it will reduce the expenses for maintenance and repair, and make the service more reliable.

In many cases, persons living along the routes (especially in streets) will make complaint against the noise, smell and sometimes dirt from the cars. These objectionable features can be minimized but cannot be eliminated, as they are necessarily incident to mechanical traction. The public benefit of the service may far outweigh the discomforts to individuals, and municipal authorities should do their part to reduce the objections by keeping the roads or streets in good condition for traffic.

The length over all should not exceed 14.75 ft., in order to allow freedom of movement. When on level ground, about 33% of the weight should be on the front axle and 66% on the rear axle. The motor should be easily accessible for inspection and renewal, and should be so attached to the frame as to be free from shocks due to rough roads. There should be an ample supply of circulation water, with pipe radiator for cooling the water. The lubrication should be with good oil and under pressure, so as to avoid trouble in cold weather. The fuel tank should be of sufficient capacity for an entire trip, as filling it at intermediate points is costly and dangerous. The exhaust should be discharged above the roof, so as not to be objectionable to persons on the road.

For city service, Mr. Mauclere prefers gear transmission to chain transmission, on account of the frequent stopping and starting. Wooden

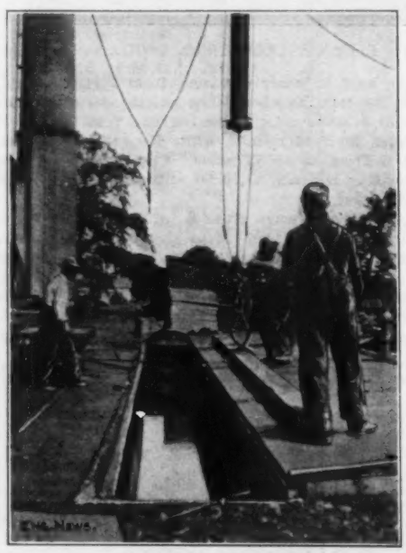


Fig. 13. Open Tank of the Milwaukee Car Manufacturing Co.

wheels are preferred to metal wheels, as being more elastic and less noisy. Side skidding is a serious trouble, especially when the road surface is slippery, and its consequences may be serious in narrow or steeply crowned streets. In Paris, it is found to be impossible to operate safely in wet weather if the cars simply have double tires on the driving wheels, and it has been necessary to use special non-skidding tires. Various designs have been made for built-up

Fig. 14. Wooden Tank for Treating Building Timbers.

elastic wheels which in themselves will absorb the shocks and so permit the use of steel tires. It is not considered that the use of steel tires can be made practicable, however, on account of the skidding, the noise and the wear of the paving.

A tabulated statement of various European lines is given at the bottom of this page.

PROGRESS ON THE ST. PAUL PASS TUNNEL through the Bitter Root Mts., between Montana and Idaho, the mountain crossing of the Pacific extension of the Chicago, Milwaukee & St. Paul Ry., has fully maintained its high rates. In November a new record for this tunnel was made in heading advance, the East heading being pushed forward 340 ft. during the month (previous high record 333 ft., West heading, June, 1908). During the past six months, June-November, 1908, the work made the following averages: East heading, 289.3 ft. per month; West heading, 281.2 ft.; both headings, 570.5 ft.; Bench, both ends, 632.5 ft. The average progress for the first 11 months of 1908 was 537.6 ft. per month.

This tunnel has a length between portals of 8,751 ft., of which 7,219 ft. was penetrated by the headings and 6,536 ft. broken out to full section by Dec. 1, 1908. It is timbered throughout except for 1,302 ft. at the west end. The section is 18 ft. 6 ins. by 25 ft. in the clear (inside of timber). It is driven by Winston Bros. Co., of Chicago; Mr. F. J. McIsaac is their Superintendent-in-Charge. Mr. K. C. Weedin is Engineer-in-Charge for the railway. The increasing speed of the work is shown by the following figures, comparing the work of November, 1908, with the previous best month's work:

	Nov., 1908.	Previous record.
Heading, one end	340	333 (June '08)
Both ends	608	628 (Aug. '08)
Bench, one end	527	415 (Aug. '08)
Both ends	855	634 (June '08)

The only figure in which the previous record was not exceeded, that of total heading progress, would doubtless also have shown a new high figure except for the fact that the West heading struck a seam of very wet running ground, tale, which stopped work for six days (Nov. 25-30). We are indebted to the contractors for the above figures.

MOTOR OMNIBUS SERVICE IN EUROPE.

Operating company.	Character of Service.	Length of trip, miles.	Daily mileage per car, miles.	Annual mileage, miles.	No. of cars.	Passengers per car.	Weight, empty, lbs.	Speed, mi. per hr.	Power equipment.
Lanc. & Yorks. Ry. (England)	Suburban.	6.20	115	34,000	2*	34	10,050	12	Gasoline, 4 cyl. 28 HP.
Caledonian Ry. (Scotland)	City and sub.	3.75	32	9,920	2	24-26	8,800	..	1 steam, 2 cyl. 40 HP; 1 gasoline, 4 cyl. 24 HP.
North British Ry. (Scotland)	Bet. two ry. stas.	10.00	96	....	2	..	6,380	..	Gasoline, 4 cyl.
Bavarian Highland Automobile Co. (Germany)	.....	32.24	65	(May to Oct.)	5	11-15	4,400	10 to 13	Gasoline, 4 cyl, 24 HP.
Bussing Co. (Brunswick, Germany)	Suburban.	....	65	23,560	2	25	8,360	12 to 13	Gasoline, 4 cyl. 18 and 24 HP.
Geneva-Annecy Auto. Co. (Switzerland)	Mountain road.	26.66	53 to 81	22,940	4	22	7,480	13	Steam, 30 and 40 HP.
Gmund Ry. (Austria)	.....	1.67	56	....	2	15-22	4,730	12 to 13	Trackless trolley, two 20 HP. motors.
St. Blase Motor Car Co. (Switzerland)	2 interurban lines on mountain roads.	18.60 & 16.12	75	7,500	7	10-12	3,960	15½	Gasoline, 32 and 40 HP.
Cologne Tramways (Germany)	St. ry. feeder.	1.00	60	....	2	21	10,340	7½	1 gasoline, 32 HP.; 1 gasoline-electric, 32 HP.
Dusseldorf Tramways (Germany)	St. ry. feeder.	2.00	80 to 110	....	2	19	12,100	9½	Gasoline, 28 HP.
Munich Tramways (Germany)	City (between 2 street railways.)	....	82	....	4	21-22	9,020	7½	Gasoline, 25 HP.
Vienna Tramways (Austria)	St. ry. feeders.	2.5 & 3.7	95 & 71	....	6	24	10,450	7½	Gasoline, 25 HP.
Paris Omnibus Co. (France)	City, 7 lines.	3.2 to 4	90	32,500	150*	32	10,604	6½ to 8½	Gasoline, 4 cyl. 40 HP.
Berlin Tramways (Germany)	City, 2 lines.	3.7 & 3.1	93	....	60*	37	12,980	8½	Gasoline, 24 and 28 HP.
Brussels Tramways (Belgium)	Experimental.	....	72	....	3	32	10,000	..	Gasoline, 40 HP.

*These three lines have double-deck cars, which type is common for English omnibus service.

ERECTION PLANT FOR CONCRETE DAM AT BELLOWS FALLS, VT.

In the construction of the concrete power dam across the Connecticut River at Bellows Falls, Vt., recently completed, the layout of the erecting plant is worthy of notice. This dam, 600 ft. long and 40 ft. high at its deepest point, was built of gravity section in mass concrete. It followed the line of an old leaky timber dam so that the construction of a coffer-dam was of no especial difficulty, but the inaccessibility of the gravel-pit and the end of the dam on the west side of the river made the details of the mixing and conveying plant somewhat more of a problem. Three

CONSTRUCTION OF DAM AT BELLOWS FALLS, VT.

plans were considered; a cableway carrier, a floating pontoon system and a trestle track from the shore. On account of the expense and the difficulty of transporting other material than concrete to the dam site, the first two were rejected and the third adopted.

Fig. 1 shows the general view of the east end of the dam looking up-stream toward the recently erected Bellows Falls arch bridge. On the west side of the river, about 50 yds. from the end of the bridge gravel was taken from a pit in an orange peel bucket which dropped it onto a screen at the top of bins, which in turn separated the pebbles from the sand. The aggregate was then carted across the river to the concrete mixer immediately at the east end of the bridge.

In the mixing plant the construction company utilized the height between the highway bridge and their track to pass aggregate from the wagon to the dump car practically by gravity and to wash the gravel in the process. The gravel was dumped upon slanting platforms, over which a perforated pipe threw a large volume of water in many small streams. At the bottom of these slopes the gravel passed over screens which dropped out the water and mud, and delivered the washed gravel into its bin. Valves at the bottom of the sand and gravel bins opened into measuring spaces and from these the aggregate and cement were shot into the mixer, and from there into one-yard cars. The cement sheds were located behind the mixing plant and arranged for minimum handling of cement. The mixer and the washing pump were driven by a 35-HP. motor located over the stone bin. Disregarding all but the cost of men employed in operating the plant, daily cost reports show washing stone and concrete mixed and delivered to the cars for 12 cts. per cu. yd.

From the mixer the industrial track ran along the shore and out onto the dam, over the crest of which it was carried on trestles. This track was extended with the dam. Concrete was transported in dump cars, such as are shown in the cut, which could be easily pushed on the level track by two men. In the cut is also shown the chute down which the concrete was put in place. In addition to the main concrete track an additional track ran directly to the shore from the dam, and on this branch track the lumber, machinery and other material were moved.

The whole plant was placed, as far as possible, above the reach of probable high water. But the continued low water of the Connecticut throughout the construction made this precaution unnecessary. Work was started Aug. 1 and completed Nov. 25 of the present year.

The dam was designed by Mr. Charles T. Main, M. Am. Soc. M. E., of Boston, and was constructed by the Aberthaw Construction Co., of the same city. The arrangement of the plant was the work of the latter.

AN ELECTRIC POWER SHOVEL, WITH COST RECORD OF ITS WORK.

Power shovels or excavators operated by electricity have been put into successful use in several cases for railway and general excavation, gravel-pit work and placer mining at points where electric current is readily available. Machines of this kind were described and illustrated in our issue of Jan. 17, 1907, and we have recently been furnished with the record of cost of work done by one of them. The work consisted in digging ballast for the Chautauqua Traction Co., of Jamestown, N. Y., and the figures of cost were given by Mr. A. N. Broadhead, the president of the railway, to the Vulcan Steam Shovel Co., of Toledo, O., which company built the machine.

In general arrangement and appearance, the electric shovel resembles an ordinary steam shovel. It weighs about 40 tons, and the car body is 27 ft. long and 6 ft. 8 ins. wide. The dipper is of 1½ cu. yds. capacity, and has a clear lift of 12 ft. with the bottom door open. The machine can make a cut 26 ft. wide at the rail level, and can dump the dipper on either side within a distance of 21 ft. 6 ins. from the center of the track. It is equipped with three motors: a 75-HP. motor for hoisting the dipper, a 30-HP. motor for swinging the boom, and a 30-HP. crowding or crane motor for forcing the dipper against the face of the work. These are all of the railway type, for variable speed (normal speed 700 r. p. m.), and working on 600-volt direct current.

The record of cost for an eight-hour run is given in the accompanying table. In obtaining this record, an ammeter and voltmeter were used on the machine. The excavator did not work continually, owing to the shortage of cars. This, of course, is a normal condition, but if it had been possible to keep the machine at work without interruption, the cost per yd. would, of course, have been less.

COST OF EXCAVATION WITH AN ELECTRIC SHOVEL

Excavation per hour	66.6 cu. yds.
Cost per hour:	
1 man at 33 cts.	$0.33
1 man at 25 cts.	0.25
2 men at 15 cts.	0.30
20.346 KW.-hrs., at 88 cts.	0.18
Oil and waste, estimated	0.04
Total cost per hour	1.10
Cost for eight hours' work	8.80
Excavation for eight hours	534 cu. yds.
Cost per cubic yard	1.64 cts.

The material was a mixture of gravel, sticky clay and sand, which was hard to dig. Nevertheless, the cost of the work was very low. Among the causes given for this, the principal are as follows: (1) as the shovel required no boiler, the cost of a fireman and of hauling coal and water was eliminated; (2) the work of the shovel was intermittent, but when it was idle no power was being consumed as would be the case with a steam shovel. The builders state that if the shovel could have been operated to its maximum capacity, it would have given twice the yardage at nearly the same cost. The men had to be paid whether they were working or idle, and the additional cost for power would not have been more than twice that given. This would mean 1,068 yds. at a cost of $10.24, or 0.958-ct. per cu. yd.

One of the principal objections urged against an electrically operated shovel is that in hoisting the dipper to make a cut it will frequently strike hard material which may stall the motor and cause it to be burned out. On the other hand, if the motor was of a size to have sufficient strength to stand such strains without burning out, it would be too powerful, and would be liable to injure or wreck the machine. In the machine described above, this objection is overcome by special means. The 75-HP. main or hoisting motor is provided with an automatic magnetic controller, and a circuit breaker which will throw off the current as soon as the motor has exerted its maximum safe power, and thus prevent any harm to the motor. The important feature, however, is the series overload relay with which each motor is also equipped. As soon as the dipper meets any obstruction in the shape of hard material or boulders, which would have a tendency to stall the motor, this overload relay automatically relieves the motor of the excess current and prevents it from being overloaded or burned out.

Another objection which has been made to the electric shovel is in connection with the swinging motor. When the crane or boom of any shovel is being swung, it acquires a momentum which if not checked may cause it to drift around too far and do considerable damage to the structural part of the machine. On a steam shovel, this drifting motion is counteracted by slightly reversing the engines. The steam acts as a cushion and allows the crane to swing around easily for the last few feet of the swing, when a little more steam admitted stops it altogether. On the electric shovel, this momentum is taken care of by the solenoid brake, the clutch of which is thrown in by springs. When the current is turned on the swinging motor, it is automatically turned onto the mechanism of the brake also, and forms a magnet which throws back the springs. Thus as soon as the power is applied to the swinging motor, a magnet is formed which releases the brake, so that the swing of the crane is free to respond to the motor. As soon as the current is cut off, it of course cuts off the magnet. The springs are then free to throw on the brake, which absorbs the shock of the momentum, bringing the crane to an easy stop at any desired point, and without any reverse power being exerted by the

motor. The swinging motor is of 30 HP., and is also safeguarded with a circuit breaker, etc.

The 30-HP. crowding or crane motor is provided with automatic controller, circuit breaker, overload relay, etc., and is safeguarded in much the same manner as the hoisting motor. In addition to this, however, it is provided with a foot brake which is operated by the craneman. Even should the circuit breaker be automatically thrown out, as the result of overloads or other causes, the foot brake is still capable of holding the dipper at any point desired.

METHODS EMPLOYED IN DRIVING ALPINE TUNNELS: THE LOETSCHBERG TUNNEL.

By WALTON L. AIMS,* M. Am. Soc. C. E.

Records of speed attained in driving rock tunnel headings show that the progress made in Alpine tunnels has far exceeded the best American records and it therefore becomes an important matter to consider why so great a difference should exist. The best American record is now claimed for the Elizabeth Lake Tunnel of the Los Angeles Aqueduct, where 466 ft. is said to have been driven in a single heading during October, 1908.† But even this record falls far short of that made at the Simplon Tunnel in the Alps where 685 ft. was driven in one heading during July, 1904.

The writer has recently visited the Loetschberg Tunnel now being built between Kandersteg and Goppenstein, near the line of the Gemmi Pass, Switzerland. In this tunnel similar monthly progress to that made at the Simplon is now being accomplished, and the results of the writer's observations are herewith appended. The accompanying map, Fig. 1, shows the location of the Loetschberg Tunnel on the line of the railway which is to connect Berne with the Simplon Tunnel route to Italy. This tunnel when completed will be about 8½ mi. long. Near the North portal the tunnel passes under the Kander River and at this point a serious cave-in, extending up to the river bed, occurred last July. This accident occasioned the temporary abandonment of the work in that heading until plans shall have been decided upon for meeting this difficulty. The work, therefore, is at present being carried on from the South portal only and the observations were consequently limited to that one heading.

The experience gained in driving the Simplon Tunnel is being used to advantage at the Loetschberg, with the difference, however, that while the Simplon was driven with rotary drills of foreign manufacture, the Loetschberg is being driven with compressed air percussion drills, those in the South heading being of American make, furnished by the Ingersoll Rand Company.

The tunnel is designed for a double-track railway and has a cross-sectional area of about 66 sq. yds. The bottom heading method can therefore be used to advantage (see Fig. 3). The bottom heading is about 6 ft. 6 ins. high by 10 ft. wide. Every 600 ft. upraises are made from the bottom heading and a top heading is started from each of these upraises. From the top headings the work of taking out the tunnel to its full section is carried on in successive stages of bench work, timbering being erected in the bottom heading during the later stages to prevent the shell of rock between the top workings and the bottom heading breaking through and thus blocking the track below. As soon as the top excavations are connected with the bottom heading the timbering is removed to be used again at another point. The sides are then trimmed out and the concrete lining is placed, largely made up of concrete blocks backed with concrete.

There is but a single track in the bottom heading, about 30-in. gage, with turnouts every 600 ft. where the upraises occur, the bottom heading being widened out at these points to accommodate the turnouts. Numerous chutes about 2 ft. square are also blasted out between the bottom heading and the top workings through which the muck is dumped into the trains of cars in the bottom heading.

By this method of working, the full-section excavation has no difficulty in keeping pace with the heading, and at the same time no delay is occasioned to the heading operations. The speed of the heading, therefore, is the speed of the completed tunnel, and hence it is the methods used at the heading upon which the main interest centers.

The secret of the great speed in these Alpine tunnel headings appears to be that a very careful study has been made of the various causes of delay in the successive operations of drilling, blasting, mucking out, and setting up the drills again, with the result that a radically different method of mounting the drills in the heading has been employed, and also a different system of blasting used, from that practiced in America.

Fig. 1. Location Plan of Loetschberg Tunnel.

In the mounting of the drills, the return to the old drill-carriage idea is disclosed, but in this instance there is no such cumbersome affair as the drill-carriage used in the early tunneling operations in this country. The drill-carriage at the Loetschberg simply consists of a small truck with a wheelbase of about 4 ft. running on a regular heading track. Mounted on this truck in the longitudinal axis of the tunnel and hinged to swing vertically is an I-beam, set with its web vertical, and reinforced to give it lateral stiffness. On the forward end of the I-beam there is mounted what in America would be called a shaft bar, set transversely and pivoted to swing horizontally. On the opposite end of the I-beam is a counterweight. Four drills are mounted on the shaft bar, the compressed-air connections from these drills running back to one hose connection at the rear of the truck.

The accompanying sketch Fig. 2 illustrates the main features of the drill-carriage. When not in use the shaft bar is swung so that it lies directly over the I-beam and the carriage can then be run anywhere over the heading tracks, occupying no more room in the heading than a couple of muck cars.

Before blasting, a ⅝-in. plate of steel about 6½ ft. by 3½ ft. is laid down just ahead of the end of the track. After the blasting is over, a cut is quickly made through the center of the muck pile down to this steel plate sufficiently wide to allow the arm of the drill-carriage to introduce the bar carrying the drills to the top of the heading, the drill-carriage running on the steel plate laid down ahead of the track. The shaft bar is then jacked firmly against the sides of the heading and drilling immediately begins on the top holes. Mucking out then continues while the drilling is in progress.

On account of the drills remaining on the drill-carriage at all times, with the air connections at the drill undisturbed, there is little chance for the dirt and grit to get into the working parts of the drill and so impair its efficiency. The drills are of large size, having a piston diameter of 3⅝ ins. (designated in the catalog of the manufacturer as "F-94").

There are from 12 to 14 holes drilled in each round for taking out the heading. These holes have a depth of 4 ft. and are 2 ins. in diameter at the bottom. They are arranged in four vertical rows, the two center rows corresponding to our center cut and the two outer rows to the side round. The two center rows, however, are not pointed to form a V as is the custom in America, but are run in more nearly perpendicular to the face.

The rock so far encountered varies from granite to gneiss and is hard drilling. The compressed air for the drills is furnished by two electrically-driven Ingersoll-Rand compressors of the cross-compound two-stage type, giving a pressure of from 90 to 100 lbs. per sq. in. at the drills.

As soon as the round is all drilled, the drill-carriage bearing the four drills is run back to the last turnout and blasting begins. Blasting at the Loetschberg Tunnel is done by the fuse-and-cap method of exploding the charge. All of the holes are loaded and the fuses of all of them are ignited at the same time. But by a careful regulation of the length of these fuses a series of minor explosions is produced, so arranged that all of the center holes are exploded before the side holes.

More powder must necessarily be used in firing in this manner, but the advantages gained are as follows: less time is consumed in blasting; the rock is broken up more uniformly; and the effect of the blasting is less severe on the track than when the system of electrical firing is employed. There is one drawback to this method of firing by fuse-and-cap, viz., the danger arising from missed holes. An attempt is made to minimize this danger by employing two fuses in all holes except those at the bottom, where three fuses are introduced.

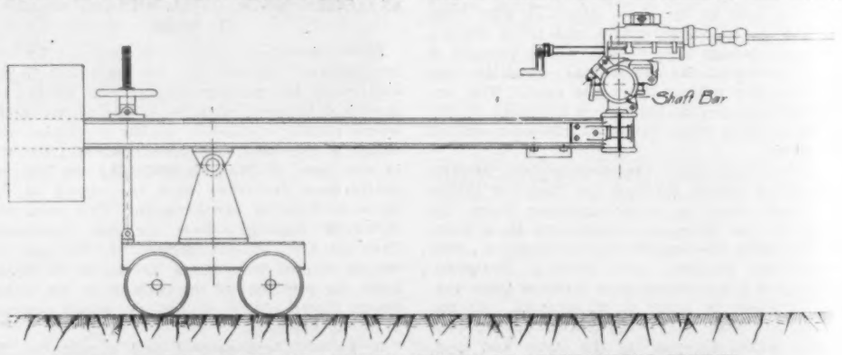


FIG. 2. DRILL CARRIAGE USED IN HEADING OF LOETSCHBERG TUNNEL.

It would seem that an electrically fired time exploder would fill a long-felt want, but while several attempts have been made to manufacture such an exploder, nothing of the kind has as yet been devised that has proved to be a practical success.

The work at the Loetschberg is carried on in three 8-hr. shifts, and each shift is expected to

*Consulting Engineer, 45 Broadway, New York City.
†Engineering News, Nov. 19, 1908, p. 570. See also a compilation of tunnel driving records in Engineering News, April 2, 1908, p. 377.

drill two rounds and to shoot twice, making about 7 ft. per shift, or 21 ft. per day. A liberal bonus is paid to the men for all speed made above a certain rate. The workmen are Italians, nearly all from the Northern provinces. The following table gives the approximate time for the various operations in the heading:

Setting up drill-carriage in the heading.....	20 mins.
Drilling 12 or 14 holes	60 "
Removing drill-carriage from the heading.....	20 "
Loading and firing the holes	30 "
Clearing out the smoke	20 "
Making cut through center of muck pile for carriage	90 "
Total	240 mins. or 4 hrs.

Ventilation is provided by means of a large fan, capable of running either as an exhauster or as a blower. From this fan a spiral-riveted pipe 2 ft. in diameter runs through the bottom heading.

The tunnel is lighted with acetylene lamps carried by the miners. Each man is required to buy his own lamp and to keep it in good working order. The light is brilliant and is always at the point where it is wanted; and there are no delays such as those arising from broken or disarranged wires where electric lighting is employed.

The difference between the methods used at the Loetschberg Tunnel and those employed at home are striking and interesting; and it would seem that by judicious changes in the present established American methods of driving rock tunnels, improvements and new ideas would enable us to equal and even to exceed the records made in Alpine tunneling.

THE DESIGN OF THE LOCK GATES AND OF AN EMERGENCY DAM FOR THE PANAMA CANAL.

In the recently issued report of the Isthmian Canal Commission, some particulars of the progress in the design of the great lock gates are given, and also information regarding the design of the emergency dam.

It will be remembered that in the discussions which have taken place concerning the relative merits of the lock and the sea-level types of canal, great stress has been laid by the opponents of the lock canal on the possibility of the upper lock gates being broken by collision with a vessel and the lake being emptied through them. It will be recalled that this contingency has been met by the provision of guard gates, so that a vessel will have to break down two pairs of gates in succession before a clear passage can be opened for the water. It has been deemed wise, nevertheless, to make still further provision, so that in the remote event of an accident of this sort occurring, an emergency dam could be placed to stop the escape of water through the locks. The design of this emergency dam has been in charge of Mr. David Molitor, M. Am. Soc. C. E. Both the lock gates and the emergency dam are under the special charge of Lieut.-Col. H. F. Hodges, Corps of Engineers, and we reprint below Appendix F. of the Commission's recent report relative to the design of these lock gates and the dam.

LOCK GATES.

The preparation of the design for the gates for the different locks on the canal is under the direct charge of Mr. Henry Goldmark, designing engineer. Prior to July 1, 1907, the work accomplished consisted mainly in a detailed preliminary design of the rolling gate for the 100-ft. lock. A general lay out was also made of a mitering gate for the 100-ft. lock.

Beginning in June, 1907, the design of the mitering gates (for a lock of the same width) was taken up in detail. The theory of the stresses in the web plates was studied, and formulae were also obtained for calculating the required flange sections by a direct method instead of the usual method by trial.

The anchorages, including the steel castings in the top of the walls, were designed in detail, and a general lay-out made for the La Boca locks. In connection with the designs of the anchorage, preliminary sketches and weight computations were made for all gates on the canal. The most important details were then taken up in succession, viz., the hollow quoin, the quoin and miter posts, the sill, the connection of gate to anchorage, the internal structure of leaf, and the question of air chambers.

In each case many alternative designs were fully studied. Those that proved undesirable were discarded and the best types developed to obtain thoroughly satisfactory details.

In view of the proposed change in the width of the locks comparative estimates were made of mitering as well as rolling gates for widths of 100, 110, and 120 ft. An extended comparative study was made of cylindrical and straight-backed gates for 100, 110, and 120-ft. locks, with two different angles of sill.

An investigation was also made of the effect of the vertical stiffness in mitering lock gates on distribution of the stresses. A general theory was developed and applied to the gates for the canal.

The studies of typical details have been revised and extended; it is believed that all essential parts have been satisfactorily covered.

At present the status of the work may be given as follows:

The general arrangement of gate leaf and masonry recesses for the 110-ft. locks have been worked out. An economical vertical spacing, involving only three different panel heights for all gates on the canal, has been determined, and the resultant loadings on all these horizontals calculated. The actual cross sections of these girders have also been practically ascertained. The same may be said regarding the sheathing plates and their intercostals.

The typical details of the hollow quoins, quoin and miter posts, and their internal bracings, as well as the bearing pieces and adjustments, the anchorage castings, the pintle, pintle castings, etc., have been drawn out in detail. These details are believed to be satisfactory solutions of the problems involved in each case. Some of them are in pencil only and all must be redrawn with the rivet and bolt spacing arranged for use in the several gate sizes.

The work remaining to be done to complete the plans of the mitering gates is approximately the following: Dimensions of cross sections in girders, sheathing plates, intercostals, etc., to be checked; lengths of cover plates, etc., accurately determined, and all details modified to correspond to individual cases.

It should be noted that the upper parts of all the gates for 35 to 40 ft. will be identical; that there will be little if any difference in the pintle castings, sills, or anchors. Hence many of the drawings will be simply outlined, the details being drawn but once.

As noted above, a detailed study for a rolling gate designed to withstand water pressure was worked out. In addition to this a variety of other forms of gate have been studied, which appeared to possess certain advantages as barrier gates to be used at the downstream end of the summit level lock.

The results of these studies seem to show that a skeleton rolling gate not adapted to resist water pressure will be the best form for use in this place.

EMERGENCY DAM.

Mr. David Molitor, designing engineer, has been in immediate charge of the design for the movable dam and has prepared the plan outlined below. The study was undertaken about June 1, 1907, at first in a general way, in order to determine the type best suited for the purpose and the peculiar climatic conditions prevalent on the Isthmus.

Any structure which would be continually under water was deemed unsuitable on the grounds of inaccessibility for painting and making repairs; also because rapid deterioration was certain to take place. Attention was therefore directed at once to the bridge type of dam.

An investigation of the hydraulic conditions of flow through the canal following the destruction of a lock gate has shown that the velocity of the current at the upper approach to the Gatun lock flight would be about 23.5 ft. per second with water at a depth of about 50 ft. With this condition as a basis, a structure is being designed which promises to be suitable.

The design has progressed to a state where all general features are definite; a few details will require some further study, and numerous general and detail drawings remain to be made, though much of the work has been finally completed, and everything has been planned as shown on the drawing herewith.

There are two vertical trusses forming a counterweighted swing bridge on which are hung a horizontal truss, six pairs of wicket girders, and six sets of gates. The horizontal truss is fastened to one side of the downstream vertical truss and the wicket frames are attached to the upstream chord of the horizontal truss at panel points. The bottom ends of the girders are hung from the upstream overhang of the swing span. This affords a most suitable system for manipulating the lowering, which is to be done from a central power to be located on the counterweight.

In operating, the current is checked by successively lowering the first set of gates across the canal and then proceeding to the second set and so on, thus gradually converting the dynamic energy into static head. According to this plan, the greatest difficulty in the way of wicket dams is obviated by obstructing the flow from the bottom of the canal upward instead of by vertical wickets, which latter method reduces the final opening to a vertical slot with water pouring through under maximum head.

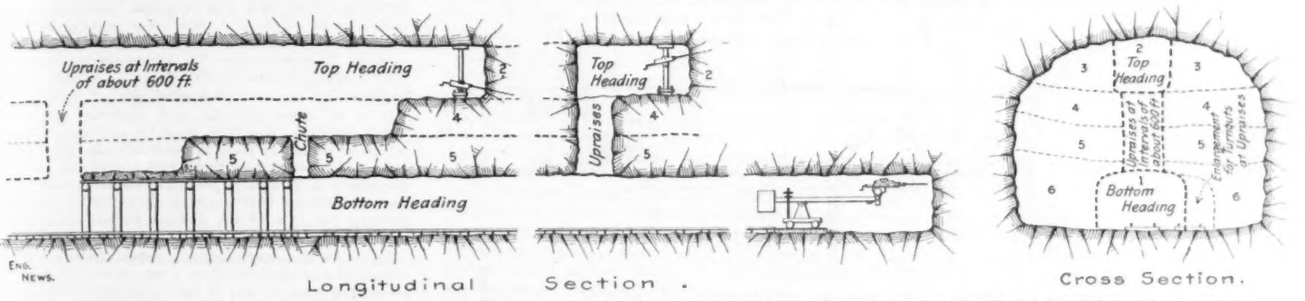


FIG. 3. SKETCHES SHOWING METHOD OF ATTACK AND SEQUENCE OF OPERATIONS, SOUTH HEADING OF LOETSCHBERG TUNNEL.

A METHOD OF DETERMINING THE MOISTURE in producer gas is described in a paper read before the West of Scotland Iron and Steel Institute by Mr. J. MacFarlane. The principal advantage claimed is in rapidity, it being possible to make a reliable determination within five minutes. The instruments used are described as follows:

The apparatus consists of a 6-in. × 1-in. test tube, fitted with a one-hole cork through which a thermometer is placed; and a gas-sampling tube. The gas-sampling tube is made of ¾-in. diameter wrought-iron pipe and is fitted with a flange 12 ins. from one end, a stop-cock for regulating the flow of gas, and a tee piece. A cylindrical sheet-iron shield 4 ins. long × 1¼ ins. diameter is screwed into either of the openings of the tee piece according to the position of the gas-sampling hole. If the latter is vertical (as the eye-hole of a producer) the shield is screwed on the end opening, and, if horizontal, into the side opening.

To make a test, the other end of the sampling tube is inserted in the sampling hole in the main or producer, and a current of gas allowed to pass freely through, till the tube is thoroughly heated (to prevent condensation of water). This usually takes two to three minutes. A little cold water is placed in the test tube, the outside dried, the thermometer replaced, and the tube is placed within the metal shield. Water deposits on the surface of the tube. The tube is frequently taken out and dried, and the temperature noted when water ceases to be deposited. The mean of several determinations is taken and a hygrometric table is consulted, when the moisture content of the gas (either grammes per cubic meter, partial pressure, or per cent. by volume) may be obtained. A sample of the gas may simultaneously be taken at the other opening in the tee tube by means of an ordinary gas-sampling pipette. Should the temperature of the gas in the main be low, it may be necessary to heat the iron tube, to prevent deposition of water, and to heat the water in the test tube up to the dew point. With a little practice, an intelligent workman can read to an accuracy of 1° C., and this is usually all that is required.

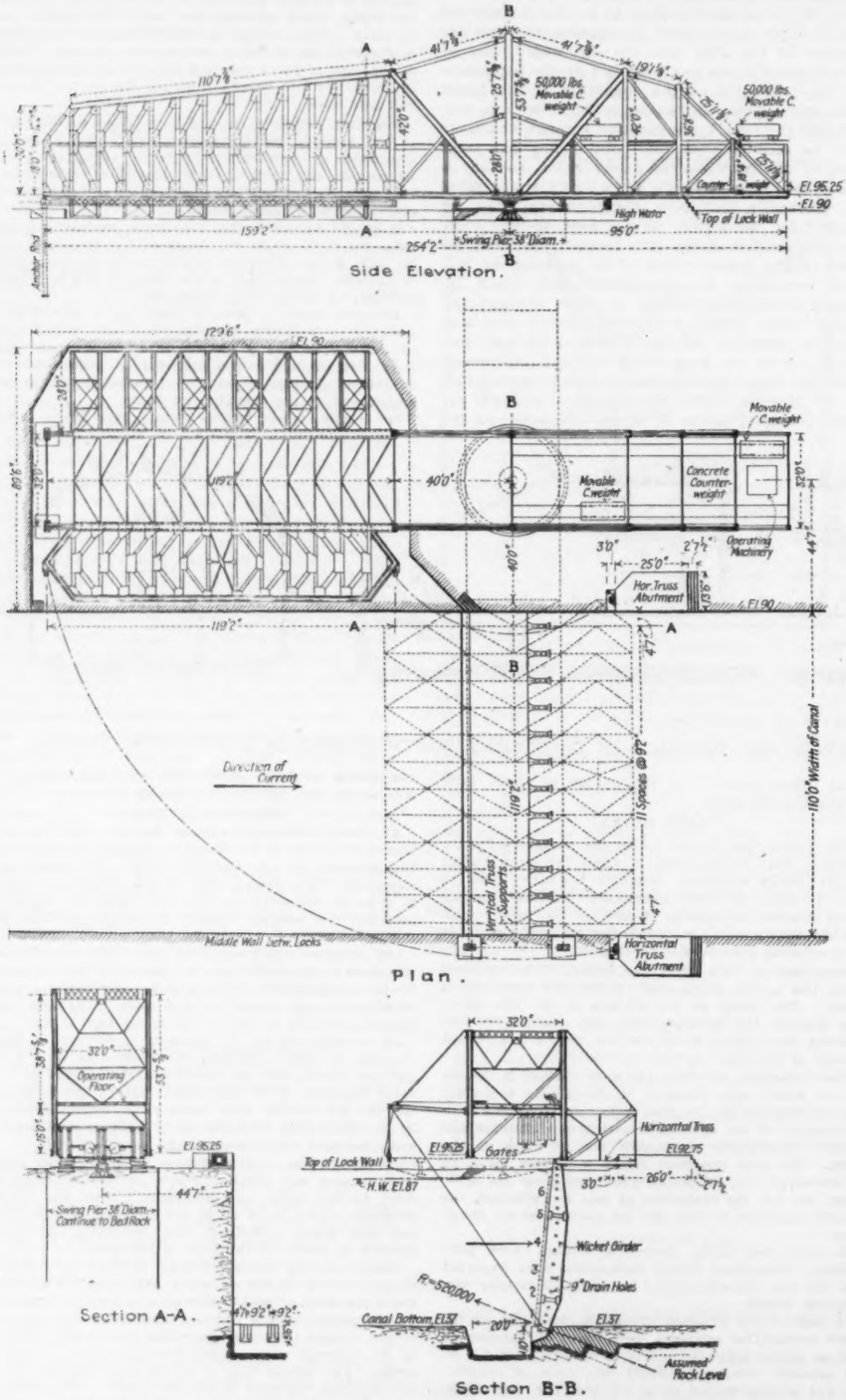
It is not possible to get as accurate results by this "dew-point" method as by the longer methods. A table of comparative results of simultaneous determinations by this and by the calcium chloride method shows differences of from 0.04% to 0.82% by volume of aqueous vapor content. In this table the total per cent. of aqueous vapor ranges from about 3½% to 12%.

Eight sheets of drawings are completed, showing the design of the wicket girders, the gates and the horizontal truss system, including all details connected with these elements.

The sway and lateral system is all sketched, but not finally dimensioned for all panels of the structure.

The vertical trusses are planned and their preliminary details worked out, but as the weights of all other parts of the structure must be accurately known before computing the final stresses in the vertical trusses, these latter must necessarily be designed last.

Attention is invited to the novel style of truss system here employed for the first time in this country. It affords the combined advantages of short panels, short members, and rigidity, and enables carrying all stresses due to maneuvering of wickets, in one plane.



GENERAL DESIGN OF 110-FT. EMERGENCY DAM CARRIED BY SWING BRIDGE. PROPOSED FOR USE AT THE GATUN LOCKS OF THE ISTHMIAN CANAL.

Designed by David Molitor, M. Am Soc. C. E.

A METHOD FOR DETERMINING THE NUMBER OF DUST PARTICLES IN AIR.*

By C-E. A. WINSLOW.†

In many branches of sanitary work, notably the study of factory conditions, measurement of dust suspended in the air is of great importance. The actual number of dust particles present is probably quite as significant as the total weight of suspended matter. With dust of a given nature, it seems probable that damage to the lungs increases in proportion to the number of particles which lacerate their surfaces. Curiously enough, however, the enumeration of dust particles has not found place in most studies of ventilation problems. In some recent work carried out at the Sanitary Research Laboratory of the Institute of Technology, a method has been devised for this purpose.

The method consists in drawing a measured volume of air through a filter of granulated sugar, dissolving the sugar, and suspending the contained dust in a known volume of distilled water, and counting the dust particles present under the microscope. The sugar may be ordinary granulated sugar, the grains of which vary between 0.25 and 1 mm. in diameter. The layer of sugar should be 2 cm. deep, and may be held in place in a glass tube of 1 to 2 cm. bore, by a perforated stopper and a square of bolting cloth. The air sample should be collected rather rapidly; and this may be done by the use of a suction cylinder of metal, with a close fitting piston. After sampling, the sugar is poured into a small graduate and dissolved in 5 to 10 c. c. of distilled water. After thorough agitation, 1 c. c. of the resulting suspension of dust in water is placed in a Sedgwick-Rafter counting cell, such as is used in the microscopical examination of drinking water. This cell is 50 by 20 mm. in area, and 1 mm. deep. The general method used in enumerating the dust particles is that described by G. C. Whipple in the "Microscopy of Drinking Water," for the study of the microscopical organisms. It involves simply the counting of the number of dust particles in a certain number of representative squares, and the calculation of the number originally present in the filtered air. It should be noted, however, that both the bottom of the liquid and its surface should be examined. Heavy dusts of course settle to the bottom, but lighter dusts may be found exclusively at the top of the counting cell.

In my work I have filtered 600 c. c. of air and dissolved the sugar in 6 c. c. of water, thus giving a concentration of 100 in 1. I count 10 sq. mm. areas in the counting cell or 1/100 of the total number present in 1 c. c. of the concentrate. The number of dust particles thus counted corresponds directly to the number of dust particles in 1 c. c. of the original air.

It is of course essential that glassware and sugar should be clean, and it is desirable that control determinations should be made in order to avoid errors due to extraneous dust. I have found that 5 to 10 dust particles per square is an outside limit for this error with ordinary cleanliness. This corresponds to 50 to 100 dust particles per c. c. of air, and the method cannot probably be relied upon below these limits.

Even with this qualification, however, the direct enumeration of dust particles offers a very delicate method for measuring dust in air. I have compared it with the method of weighing, with the following results, using dust swept up from the floor of the laboratory and shaken up in a large bottle, to give an extreme condition of dustiness. I found in one case that 16,000 dust particles per c. c. corresponded to a weight of 3 mg. In another case 13,000 particles per c. c. corresponded to a weight of 10 mg. With the dust method one can easily estimate numbers of dust particles down to 100 per c. c. which would correspond, in the case of the dust studied, with weights of 1/10 mg. or less, amounts which could hardly be determined accurately by the ordinary methods of filtering and weighing.

An additional point in favor of the method of enumerating dust particles is the opportunity for observing the nature of the particles themselves.

Their size may also be estimated if desired. The standard unit used in the microscopical examination of water (see Whipple), may be used for this purpose. It is not suggested that the enumeration of dust particles should in any way supplant the determination of the total weight of dust present. It is rather urged that it should be used in combination with the usual procedure for additional information.

*A paper read before the 1908 meeting of the American Public Health Association, Winnipeg, Manitoba.

†Massachusetts Institute of Technology, Boston, Mass.

EVERLASTING STAIR TREADS.—No doubt some of your readers who have to provide for endless streams of passengers would like to know where the above were to be got, providing the price was not prohibitive. Well, we think we have solved the question, and as the idea is not patented or protected in any way, we have pleasure in asking you to publish it for the benefit of the world at large.

We may say that in our emery mills we had a tremendous lot of trouble in renewing stair treads, owing to the workmen's boots becoming charged with powdered emery, glass and garnet, and this wore down smooth any material we could find, ordinary ballast concrete became polished like glass, and ribbed cast iron had a short life. This went on for many years, until one of the masons, as a trial, made a concrete of ordinary Portland cement and 16-hole emery. About half-an-inch of this was put at the bottom of a mold and the rest of the stair tread was filled in with ordinary ballast concrete, without iron, according to the requirements. The treads were afterwards allowed to harden off, exposed to the air and weather. Some of the earlier experiments have been in use a very long time without showing signs of wear or becoming slippery.

As the top layer of emery concrete is thin, the cost is not excessive, when the emery is bought in quantity. But we might mention that there are many kinds of emery, some quite unsuitable for this work. What is wanted is a very hard non-friable stone.—From a letter in London "Engineering," Dec. 4, by A. C. Pumbulow, Manager, Imperial Emery Works, Weston St., London, S. E.

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We referred in our issue of Dec. 17 to the extravagant statements made by some of those who are prominent in advocating a huge bond issue by the Federal Government for waterway improvements. A Washington dispatch, dated Dec. 21, quotes the recognized leader of the waterway boomers as follows:

> If the country is willing to spend $10,000,000 annually in the way of interest on bonds, the sum of $500,000,000 a year can be saved on freight rates, according to the assertion to-day of Representative Ransdell, president of the National Rivers and Harbors Congress. This, Mr. Ransdell says, is his excuse for asking the national lawmakers to authorize a bond issue of $500,000,000 for waterways improvements.

Certainly $500,000,000 a year is a large enough saving to be very attractive, but how could such a saving be made were the deeper waterways which Mr. Ransdell advocates available for use to-day? The only way possible would be by transferring a part of the freight which is now carried by railway to water routes, where, according to Mr. Ransdell, it would pay a lower rate for transportation, and consequently a saving would accrue. Reference to the statistics of Poor's Manual shows that in the last fiscal year the people of the United States paid a total of $1,825,000,000 to the railways for freight transportation. Suppose, for the sake of argument, that by transferring a part of this freight to water routes it could be carried on the average at half the cost per ton mile (a supposition, which, from the engineering standpoint, is far from probable). Then, in order to save $500,000,000 a year, it would be necessary to take away from the railways *over half of the freight which they are now carrying*; and the railways, instead of receiving $1,825,000,000 for freight transportation, would receive only $825,000,000. Of course, any such reduction in the volume of freight traffic on the railways of the country would land every railway from the Atlantic to the Pacific in bankruptcy, provided the rates charged remained the same. It would be absolutely necessary to materially raise the rates charged by the railways on other freight in order to enable them to continue operating at all, to say nothing of paying anything to their stock and bondholders; and this raise in rates would compel a transfer of even more freight to the water routes in order to make the saving which Mr. Ransdell claims to be possible.

It ought to be evident to every man of intelligence that in the long run the public must pay the whole cost of carrying on the business of its transportation routes, either by water or by rail. Duplication of facilities, where not demanded by the volume of traffic, results in ultimate loss to the country, and means an increase in rates on freight rather than a reduction. Of course, temporary reductions do occur when rival routes compete for the mastery, but any such temporary competition is short-lived and losses incurred in it must be made up later by the public.

It may be pointed out, too, that the estimate of $10,000,000 interest on bonds as the sole burden resulting from an expenditure of $500,000,000 on waterway improvements is very, very wide of the mark. The $10,000,000 estimate is based, of course, on the supposition that all these government bonds could be marketed at 2%. As a matter of fact, however, bankers and financiers are agreed that the only reason why the government bonds now being issued can be sold at so low a rate of interest is the very small amount of such bonds available for investment, and the artificial market created for them as security for bank circulation. If the government were to put out a bond issue of $500,000,000 it would almost certainly have to pay as much as 3% interest; nor would this be the total annual burden resulting from such a bond issue. Some annual contribution to a sinking fund ought to be made to pay for the bonds at maturity, if we are to keep our national finances on a sound basis. Besides this, waterways do not maintain themselves any more than railways do. The annual cost of maintenance on $500,000,000 worth of waterways would amount almost certainly to far more than the interest charge. A glance at the annual reports of the Chief of Engineers will show that a very considerable proportion of the government's present expenditures on river and harbor work are necessary expenditures for maintenance of existing waterways; and the deeper our waterways are made, the greater the tendency in general for them to fill up and require dredging.

We call attention to Mr. Ransdell's claims, not in any spirit of opposition to waterway improvements, but to illustrate the necessity that such work be planned under expert guidance. The American Republic before it borrows money or spends money in enormous sums on waterway improvements ought to have a far better and safer estimate of the resultant benefits from such work than the absurd statements which are quoted above.

Highway bridges with steel trusses and reinforced-concrete floor-slab seem to be coming into favor. Many such bridges have been built in the last few years. The solid floor has notable advantages in permanence, rigidity and reduction of vibration, as compared with the common plank floor. To offset this, the dead load is considerably greater, so that some extra metal will be required in the trusses. But this is a small matter, and the type gives promise of much usefulness.

Several recent accidents, however, point out a danger, peculiar to this type of bridge, which must be guarded against if the type is to prove satisfactory. We refer to the possibility that the structure may be overloaded by excessive thickness of concrete or macadam or both. Within less than three months, two new bridges collapsed from this cause. One was not yet completed, the concrete work being still in progress; the other had been completed only a short time. The second of the two cases, the more interesting of the two, may be summarized briefly as follows: the plans specified a concrete floor 6 ins. thick, but the company's erecting foreman, in the laudable desire to do a specially good job, put on more concrete than called for, making the floor at least 8 ins. thick on the average. Thus, when the bridge company turned over the bridge to the authorities, it already had an excess of weight amounting to 20 or 25 lbs. per sq. ft. of floor. Then came the town authorities with their road gang, to put on gravel surfacing. The design provided for 3 ins. of gravel; the road men were lavish with their material, however, and put on an extra thickness, crowning up to about 12 ins. at the middle, and thus adding 40 lbs. unnecessary load. The total excess of dead weight then was 60 lbs. per sq. ft., over half the entire provision for live-load (100 lbs. per sq. ft.). It will not be surprising that when a heavy load came on the bridge fell down.

To prevent the recurrence of just this state of affairs in another case is difficult if not impossible. Still more difficult is it to make sure that the annually repeated road repair work will not result in adding quite materially to the load. We must remember that the customary 100-lb. live-load provision affords only a small margin for overweight; an extra layer of stone or gravel cuts down the live-load capacity very quickly.

A convenient rule to remember in exposed steel construction of all kinds is this: Extra thickness of metal increases the *cost* in *less* proportion, and increases the *value* of the structure in *greater* proportion, than the ratio of increase of weight. This rule holds true very generally, indeed with but very few exceptions. It has special force in the case of highway bridges, where low live-load margin, high secondary stresses and deficient rigidity operate to cut down the margin of safety against contingencies. The rule suggests one of the best of the several available precautions against the danger of overweight cited just above; to increase the truss sections by a liberal percentage as a reserve. There need be no fear that the slightly greater investment will be unprofitable.

In a recent paper before the American Institute of Electrical Engineers Mr. W. S. Murray, Electrical Engineer of the New York, New Haven & Hartford R. R., frankly disclosed the difficulties which beset that railway in trying to handle its trunk-line traffic by the alternating-current overhead-conductor system. This paper is reprinted nearly in full in another part of this issue, and our readers will notice several important departures from the original form of the system as described in Engineering News, Sept. 5, 1907. The admissions of Mr. Murray as to the troubles that at one time seriously threatened the operation of this section of the railroad will be taken doubtless by the opponents of the single-phase or the alternating-current idea as proof that the system is inherently defective. But while the New Haven system may be said to be still on trial, it must be borne in mind that the most serious troubles appear to have been successfully met. The traffic of the system is being handled and, if we accept the reports of commuters on this road, with greater comfort, convenience and reliability than was the case with steam traction. If this satisfactory record is continued—and there is every reason to suppose it will be—the difficulties passed through during the period of trial may well be forgotten. It is interesting to note the opinion of Dr. C. P. Steinmetz in the discussion of Mr. Murray's paper. He said frankly that for trunk-line service, where heavy train units must be handled at high speeds, over comparatively long distances, the single-phase traction system was proving a success.

AN EFFORT TO REGAIN CONTROL OF OR AT LEAST DETERMINE STATE WATER RIGHTS IN NEW JERSEY.

A striking example of the folly of allowing public-service corporations to control instead of being controlled by the State is afforded by New Jersey. Several volumes would be required to tell the whole of the New Jersey story. The merest fragment of the story is given, or perhaps one should say hinted at, in an abstract of the 1907-8 report of the State Water-Supply Commission of New Jersey which appears elsewhere in this issue. The commission named was created a year or two ago to look after the interests of the State as regards the diversion and use of surface waters for public water sup-

plies. Among other things, the commission is charged with seeing that in the future the available public water supplies of the State shall be fairly apportioned among all who are properly in interest, instead of monopolized to the prejudice of any rightful claimant for a portion, and that where the water consumption in any community is in excess of the liberal allowance of 100 gals. per capita the State shall be paid therefor at the moderate rate of from $1 to $10 per 1,000,000 gals., the exact rate to be determined by the commission.

All this seems simple enough, but as regards a considerable proportion of the population and available water supply of the State the commission finds itself unable to administer the act. This is due to the fact that a company, or one might say an intricate aggregate of companies, virtually claims ownership of all the potable water afforded by the most important river in the State. This has come about, although of course the commission does not say so, because the water trust has controlled the State instead of being controlled by it. This control, in certain of its antecedent forms, began a century or so ago. All who have previously attempted to break it have been broken instead, and it remains to be seen whether the present commission will fare any better. If an honest and earnest attempt be made, however, there is no apparent reason why the commission and the public should not at least find out what property rights and what measure of control in and over the waters of the Passaic River still remain vested in the commonwealth.

From the excerpts which we have taken from the report of the commission it can be seen in part, but in small part only, how involved the affairs of the Passaic water trust have become, or have been made to appear, through the amalgamation of old and the creation of new companies and the transfer and re-transfer of property. All the accessories of a "trust" are in evidence, including an over-company, as the "Securities Co." may be called.

A curious and perplexing feature of the act creating the present State Water-Supply Commission may be noted. That portion of the act providing for collecting revenue for water used in excess of 100 gals. per capita is limited to cover only water "legally diverted." Who, we ask, would ever think of limiting such revenue to water "legally diverted" unless with some ulterior motive? The commission is perplexed by this limitation. If it should collect revenue for water which has perhaps been illegally diverted, without the question of legality having been adjudicated, might the collection of such revenue raise a presumption of legality against the State? Or, if the diversion be illegal what duty, if any, does that impose on the commission?

Such brief space as we can here give to these involved questions serves to convey only a faint idea of the public-service-corporation situation now prevailing in New Jersey. Gas and electric lighting and street railway matters are in many respects even further beyond the control of the people than are public water supply facilities, but there is less excuse for the neglect of public control of water supply than of lighting and transit facilities, because water is of more primary and vital importance to the people, and because the need of controlling it in the interests of the public was brought and kept before the public for many years, at the very time when the water trust was entrenching itself in northeastern New Jersey.

As we stated in a lengthy review of the subject in our issue of April 25, 1905, "the great struggle between the [then] would-be water monopolists and the people began in 1881." Shortly afterwards, a State Water Supply Commission was formed, which was instrumental in killing a scheme to divert 50,000,000 gals. a day from the Ramapo River, before that Passaic tributary enters New Jersey, for the supply of New York City. The commission soon worked out the preliminaries for a joint publicly-owned water supply for Jersey City, Newark and eight other New Jersey communities, and had in mind the needs of other portions of the State. Such activities were not agreeable to the water promoters, who were then engaged in an ambitious scheme to supply not only a large part of northeastern New Jersey, but also New York City, from the Passaic and its tributaries. The commission suddenly found itself without appropriations, and was finally reduced to two members, through failure to fill vacancies as they occurred. Public agitation, through the press and otherwise, kept these and other facts before the people, but the people were so apathetic and the promoters so aggressive and so powerful financially and politically that the private water interests finally had everything their own way, with the results which now confront the present State Water-Supply Commission. It will be highly interesting to see whether the present commission will serve the people or will succumb to the water trust. The outcome will depend largely upon the degree and character of the public support given to the commission.

IS AN INCREASE IN RAILWAY RATES JUSTIFIABLE?

A number of commercial organizations have recently taken up cudgels in defense of the railways, and have adopted resolutions declaring that the railways should be let alone and should have a chance to earn a fair profit on the money invested in them. This newly-discovered friendship for the railways, however, appears to dissolve under the acid test. As soon as a definite proposal is made to raise railway rates in a section where any of these commercial organizations are interested, emphatic protests are at once heard.

Of course, this is what must naturally be expected. Conflict between the railway and the shipper, as between the buyer and the seller, is more or less inevitable from the nature of things, and the state of affairs merely illustrates the absolute necessity for the tribunals, in the shape of State and Federal railway commissions, which have been established to adjudicate between the two parties.

There has been much talk of raising railway rates for a year and a half now, and it is stated that some advances have already been made. It is now definitely announced, however, that on Jan. 1 a horizontal raise of 10 to 18% is to be made in the rates on through transcontinental freight. The trade associations on the Pacific coast, and to some extent those in the Eastern commercial centers, are making a strong protest against this increase; and it is a fair question for consideration whether such an increase or any increase in rates at the present time is justified.

The shippers and the railway advocates are entirely in agreement upon the proposition that the railways ought to be permitted to charge rates high enough to pay the cost of operation, including reasonable wages to labor, and, in addition, net profits enough to pay a reasonable return on the capital actually invested. The point of disagreement comes over the question what is the capital actually invested and what is a reasonable rate of return upon it. Again and again, in State and Federal laws, has the principle been stated that the railways are entitled to charge reasonable rates, and a reasonable rate is usually defined about as in the above statement. But lawmakers and courts are still in confusion over methods of determining what is the capital actually invested, and as to what rate upon it is to be considered a reasonable return.

Passing even these questions, however, it is important to call attention at this time to the great influence of *volume of traffic* in fixing rates which shall be reasonable. A railway may earn enough to pay an excellent dividend to its stockholders and invest besides a considerable amount in permanent improvements during seasons of heavy traffic, such as 1906, and yet, when charging the same rates, it may find difficulty in paying its operating expenses and fixed charges when traffic falls off, as it did in the first half of 1908. This is not an imaginary case but an actual fact. Moreover, the volume of traffic is already recognized as an important factor in fixing reasonable rates. Many short l[illegible] railways, with thin traffic, have to charg[illegible] to 10 cts., or even more, per ton-mile for fr[illegible] traffic in order to remain solvent.

The question whether a general in[illegible]se in railway rates is justifiable or not at th[illegible]resent time, therefore, depends a good deal [illegible] what the outlook for the coming year is to b[illegible] If we are entering on another season of gr[illegible] prosperity, in which the railways are to ha[illegible]mple traffic to keep their rolling stock bu[illegible] it is probable that present railway rates, properly maintained, would give them as a wh[illegible]ample earnings to meet all requirements for [illegible]ation, maintenance and profits. If, on the oth[illegible] hand, the railways are to continue to operat[illegible] with a reduced volume of freight and passeng[illegible] traffic, then many companies would be justified [illegible] raising rates to some extent in order to give [illegible] proper return to the holders of bonds and sto[illegible]s. As between these two prospects, the probabilities favor the former. All the foundations for a return of prosperity appear to exist at the present time. While a sudden boom is improbable, and would indeed be undesirable, a steady increase in business activity during the year to come is prophesied by nearly all intelligent observers. This means increased freight shipments and increased travel, with consequent increased earnings for the railway companies.

Suppose, however, that such a plan as is proposed for increasing the charges on transcontinental traffic by 10 to 18% were generally applied to all freight traffic throughout the country. The results would be an enormous increase in the net earnings of railway companies, because an increase in the rate charged is wholly net profit, and is not partially offset by increased expenses, as is the case with the growth in traffic. It will be apparent also that an increase in gross earnings of 10% would mean a very much larger percentage of increase in the net earnings. If these net earnings were distributed in extra dividends or were used to pile up a surplus for use in stock market speculation, as has been done by some well known railway corporations, the inevitable result would be the injection of water into railway capital accounts and a stimulus to the building of parallel and unnecessary railway lines. If, on the other hand, the increased earnings consequent upon an increase of rates were made use of in permanent improvements, the extension of signaling, the increase of double tracking, the erection of permanent structures and similar work, then there would be much to justify a reasonable increase in railway rates.

It is true that very large expenditures must be made by the railways of the country during the next decade. Many of these expenditures, unfortunately, like the removal of grade crossings in cities, will give no additional revenue, and it will be difficult, and on many accounts undesirable, to provide for them by issuing additional capital. If the revenue from increased railway rates were made use of in ways like these, as it would undoubtedly be by many of the best managed companies, very much could be said in its defense.

Finally, it may be noted that, comparing the different sections of the country and the different classes of traffic, transcontinental freight rates seem to need revision less than rates in other localities. The railways to the Pacific coast have fared exceedingly well during the depression of 1908, and their outlook for large profits in the immediate future on the present scale of rates is certainly very promising. On the other hand, the railways in the South, for example, have suffered seriously during 1907-08, and it is probable that an increase in their rates would be as justifiable as an increase in any section of the country. It should be said, too, that so far as rates are based upon cost of service, it is local rates rather than through rates that need to be revised upward. More and more is it coming to be the case that the great expense railways are under in handling freight is not the actual haulage over the road, but the handling at terminals. It is probable that at the present time a considerable proportion of the local freight

haulage short distances is handled at an actual loss to the railway, or at best a very small margin of profit, when the interest on the actual value of the investment in terminals is given full consideration. On the other hand, freight which can be made up in full trainloads and hauled long distances costs the railways less and less every year. Any increase of rates which tends to reduce the amount of traffic of this class, therefore, or divert it to water routes, is against the interest of the railways themselves.

LETTERS TO THE EDITOR.

Mr. John F. Stevens on the Gatun Dam Design.

Sir: The thanks of the engineering profession of the United States are due to Engineering News for the editorial comments which appeared in your issue of Dec. 24, on the recent outbreak of yellow journalism in regard to the Gatun dam. It is high time some recognized, qualified, standard authority on engineering questions took up the matter.

This is merely an individual expression, which may be justified by the writer's former connection with the work, by which he can justly be considered to be as well qualified to judge as to the actual conditions, as are some of the "eminent engineers" who are being so widely quoted.

If there have been any lingering doubts in the minds of any engineers as to the practicability of the plans for the Gatun dam, a study of Mr. Saville's report should dispel them. The report is a masterpiece, but will be entirely thrown away on the class of people who are, for reasons entirely apart from the merits of the case, making these attacks.

You are entirely correct in your suggestion that the long down-stream toe of the dam, as planned by the engineers, was a concession to prejudice. So was at least 25 ft. in the height of the proposed dam. And the writer had intended, at the proper time, to have taken up the question of a reduction in the cross section before actual construction had begun. It is certain, had private enterprise been financing the work, that a less massive structure would have been considered absolutely safe.

The animus of the attack on the canal work lies deeper than any alleged fears as to the practicability of the proposed dam or locks. A recent suggestion in the newspaper which is at the head and front of the agitation, to the effect that "had not the whole work better be dropped, and the money already spent be charged up to profit and loss," is very suggestive. Once such action was taken, the Nicaraguan scheme would come to the front, backed again by all the powerful influences which before tried to foist it upon the American people for reasons not hard to understand.

The question of the advisability of building an Interoceanic Canal has nothing whatever to do with the matter. The people have decided they want the canal, and they are ready to pay for it. The choice of its location has been wisely made, and the work properly planned. It is in competent hands, and is being executed with a rapidity that surprises even its friends. And the thing to do is to extend to Col. Goethals and his assistants all the encouragement and moral help possible, which the importance of the work demands. And the engineering world will have every reason to be proud of the result, when it is an accomplished fact.

John F. Stevens.

New Haven, Conn., Dec. 26, 1908.

A Linoleum Wearing Surface for Concrete Floors.

Sir: I have read in Engineering News descriptions of many fine concrete buildings, and in every case, in offices, the floors have been covered with hard wood, which introduces a large amount of combustible material in a building supposed to be fireproof.

I recently built a concrete extension to my factory (Tucker & Vinton, contractors) and, having no external fire risk and the goods manufactured being non-combustible, I decided to use as little wood as possible and carry no insurance.

The contractors recommended maple flooring for the office and I found that that material was commonly used elsewhere; but I would not have it. I had observed that good quality linoleum would wear better than wood, so I had the office floors troweled off smooth and decided to cement the linoleum directly to the cement surface.

None of the linoleum concerns would take the contract, as they said "the moisture in the concrete will loosen the cement"; but I did not agree with them, so I had the linoleum fitted to the different rooms and did the cementing with my own force.

After carefully fitting the material to the edges of the room, the men would roll it back from one-half the space, carefully sweep the floor and scrape off any unevenness. Then the cement surface was covered to a depth of about 1/16-in. with liquid fish glue thinned down slightly with hot water so that it could be worked with a large kalsomine brush. On many places the glue would be fully ¼-in. deep and we have observed that there is little danger of applying too much.

After coating the surface with glue the linoleum was carefully rolled back into place and for a few minutes a dozen laborers would walk back and forth over it to ensure even contact. Then the operation would be repeated over the remaining half of the room. As soon as the covering was laid, the entire surface was covered with brick, sections of structural steel and other pieces of flat, heavy material and allowed to remain for several days.

It was found that the glue would quickly harden at the seams and edges, but remained moist elsewhere for several months. Nevertheless the atmospheric pressure was sufficient to prevent the slightest buckling at any point, even under constant use, and to-day, after over twelve months' hard service, we have an ideal floor surface.

The floor is almost as quiet as if covered with rubber, yet it has the feeling of wood and the firmness of cement. When wiped over occasionally with linseed oil and turpentine it remains perfectly waterproof.

The linoleum for the surface of about 4,000 sq. ft. cost $400 cut to fit the rooms. We used just 50 gallons of liquid glue at a total cost of $85. The labor amounted to about $95, including the carrying of the large amount of brick for weighting the surface. Thus the total cost was but 14½ cts. per sq. ft., probably less than half the cost of the average maple floor.

As our partitions are all of reinforced concrete 5 ins. thick poured in place, and the only woodwork is about the door openings, we consider our offices practically fireproof. Even if it were possible for the linoleum to burn off from the cold concrete surface, its calorific value is so small that it would not add appreciably to a fire.

Yours truly, S. W. Rushmore.

Office and Works, 629 South Ave., Plainfield, N. J. Dec. 12, 1908.

The Value of Crusher Dust as Waterproofing Material in Concrete.

Sir: It is often stated that concrete can not be made water-tight without the aid of some special waterproofing material. In this connection I desire to call attention to a 2,000,000-gal. reinforced-concrete reservoir for shop water supply recently built by me for the Union Pacific Ry. at Ogden, Utah, in which proper selection of aggregate resulted in tight construction. The reservoir had the following dimensions: 100 ft. wide, 160 ft. long, 21 ft. deep and 20 ft. from bottom to edge of overflow weir. The vertical side walls were 8-in. at the top and 18-in. at a depth of 10 ft. 6 ins., from which point a slope was made to the bottom 9 ft. 6 ins. below. This slope wall was 8 ins. thick and reinforced with ½-in. round rods, spaced 1 ft. c. to c. The bottom was 6 ins. thick with the same reinforcing as the slope walls. The excavation was made in a very porous clay with the exception of some along the west slope where a coarse gravel was encountered. Some trouble was caused by the caving of slope wall on account of water seeping in. After the excavation was completed, 4-in. porous tile was laid 14 ins. below the sub-grade to dry it out before the concrete work could be started, these tile were run to a sump near the flush drain of reservoir into which the water was siphoned. They still remain in position and are connected with a 4-in. pipe into the flush drain, giving a free outlet to any seepage water that comes from the ground around the reservoir as well as what comes through the reservoir walls and floors. At the present time the discharge will not exceed a ¼-in. pipe under a 3 ft. head.

The concrete was made of one part cement, two parts ordinary sand, and four parts of crushed stone with dust in same. The stone was crushed in a small jaw crusher to 1-in. size, and was composed of quartzite boulders, porphyry and flinty limestone mixed, making a heavy percentage of crusher dust and sand. The concrete was machine mixed and to a consistency that would almost pour. The bottom was laid in block about 15 ft. sq., allowing a half-lap of 2 ft. The slope and side walls were put in with movable forms and in 20-in. layers running clear around reservoir. The finishing consisted of washing the walls and floor with 1:1 mixture of crusher dust and cement with an ordinary broom cut off to give a stiffness to the straws.

The water coming in this reservoir is snow and spring water, and is taken into an 8-in. wood pipe line 3½ miles above reservoir in mountains at an elevation of 6,300 ft. and carries only a trace of silting material. In the year this reservoir has been in service, the surface of water has varied, as the flow and consumption would increase and decrease, from 4 ft. to full 20 ft. depth, and at this date there is not a check in the entire surface of concrete that can be noticed. The small flow at the present time, coming from the tile placed under the floor, indicates that there is no seepage from the reservoir. In the past 4 or 5 years I have had occasion to examine several reinforced-concrete reservoirs and water tanks, and these examinations have proven to my mind that concrete can be made water tight by using stone crushed from a ¾-in. ring size, down to and including the dust, if enough good clean sharp sand is added to fill all voids completely. Yours truly,

A. Q. Campbell,
Assistant Engineer Oregon Short Line Ry.

Ogden, Utah, Dec. 11, 1908.

The Possible Deteriorating Effect of Included Clay on Concrete.

Sir: Laboratory experiments generally show that the presence of clay as an aggregate for concrete up to about 6 or 8% does not diminish the strength, especially in the case of lean concretes. However, there are cases in which it is dangerous to allow the presence of this fine material. The following is an instance:

The gravel used for a reinforced-concrete building contained 5% of clay. The column was poured with very wet concrete and the latter was thoroughly churned in the column molds. This churning brought the fine clay to the surface of the liquid concrete and left a stratum of 1½ ins. of worthless material near the top of the column. Fortunately, this was discovered before the remainder of the column was poured and the defective material was removed.

I have not seen any reference to this action of fine materials and wonder if others have noticed such action.

Respectfully yours,

H.

Lafayette, Ind., Dec. 18, 1908.

Sir: For several years the use of clay in concrete has been the subject of considerable thought and experiment, judging from the discussions on the question that have appeared in the technical papers from time to time. At one time if the aggregate contained clay it was at least considered inferior, but a study of these discussions would lead one to believe that clay, in homeopathic doses at least, was a good thing for the mixture.

In your issue of Sept. 26, 1907, p. 34, commenting editorially on an article in the same issue by Mr. Gaines of New York City, on the use of clay in concrete for waterproofing purposes, you state that "the presence of free pulverized clay in a concrete mixture has long been known to add to its strength." In the same article you give a list of various tests that have been made to establish this fact. Mr. Gaines' experiments would also show that the addition of clay added to the strength and impermeability of concrete.

In all of these articles, and experiments, there does not seem to have been sufficient consideration given to the possibility of ultimate deterioration of the concrete, due to the adding of clay to the mixture. In the editorial referred to you make the following statement:

Clay is a substance of great physical variation. Different clays may possibly give different results. It is even possible that clays containing some constituents (iron oxide, for example,) might eventually give trouble from discoloration, or even lead to disintegration, when other clays give perfect satisfaction.

In that word "disintegrate" there is, it seems to me, the suggestion of a possible danger that has not received the attention that its importance deserves, and may not the danger arise from the clay itself, and not from something which the clay contains? It has certainly been thoroughly demonstrated that a good Portland cement, and a good clean aggregate, when properly combined, will make a concrete that will resist the actions of the elements, but it has not been so certainly demonstrated what the effect of the introduction of another ingredient will be.

It seems to me that our knowledge of what gives to concrete its property of resisting the action of the elements is still too limited to accept as good practice the introduction of another ingredient without something more to warrant it than a few experiments or laboratory tests.

The permeability of concrete is undoubtedly a very objectionable quality and makes it difficult to use it in a great many places, but is not this property the very one which gives it its power to resist the action of moisture and frost? To this permeability may be due the perfect diffusion of the water throughout the mass in such a way that when freezing it does not expand so as to separate the particles composing the concrete. Then if any substance is introduced that stops this diffusion, we must make the concrete so perfect that there are absolutely no voids or cracks in which water can collect in such a way that it will expand when freezing, otherwise it seems to me disintegration is bound to take place. Anyone who has handled or made concrete under ordinary conditions knows that it is practically impossible to make it without some slight pockets or openings where water will collect, provided the walls forming these pockets are impermeable, so that the water cannot escape. Concrete without voids can be made if subjected to sufficient pressure after being deposited, but for ordinary work this is not feasible.

That some concrete will disintegrate under the action of the elements has been pretty thoroughly demonstrated in Milwaukee and vicinity. Walks laid last summer have shown the greatest tendency to disintegrate. Many of these that seemed to be all right in the fall proved to be defective

this spring. In general the work seems to be very much inferior to work done in the past, when more crushed stone and lake sand was used. The price of crushed stone of late years has caused the use of much more bank gravel than formerly, which, judging from the results obtained from the use of bank gravel in North Milwaukee, would, in the writer's opinion, account for the contractors' trouble. Many examples of this disintegration might be noted, but it would be only multiplying instances. However, from the fact that two or three different kinds of cement were used, that all of the concrete hardened up in good shape and showed no signs of deterioration until after freezing commenced, which was several weeks after the concrete was placed, and from the fact that disintegration was the greatest where the gravel containing the greatest amount of clay was used, one is certainly led to believe that clay, or something in clay, in sufficient amounts will cause the loss of frost resisting property in concrete.

I am aware, of course, that these are not scientific proofs, but it seems to me that there is sufficient evidence given to make anyone who contemplates putting in concrete where it will be exposed to frost give the matter careful consideration before they use an aggregate containing much clay, and will avoid clay as much as possible until the question of the possible injury which it may do has been definitely settled.

In conclusion I wish to say that I believe that the final decision of engineers and users of concrete, in reference to the properties of concrete affected by clay, will be: 1st. That clay increases the impermeability; 2nd. that it decreases its frost resisting power; 3d. that it decreases its strength.

This last statement I know is not in accordance with the opinion now held by some engineers. Their claim that it adds to the strength of concrete may be true when it is made under certain ideal, or laboratory conditions, but under average conditions obtainable in actual construction work, I am convinced that the results will show this to be an erroneous conclusion. I know that I have obtained better concrete, both as to strength and wearing qualities, for the surface of floors, by washing the gravel. This is true for gravel with a comparatively small amount of clay.

When the truth is fully known in regard to the effect of clay on concrete, I believe that in work requiring a maximum strength or wearing qualities, with a minimum of cement, or where the greatest resistance to the weather is desired, if the aggregate to be used is gravel, with an appreciable amount of clay in it, the specifications will require that the gravel be washed.

Yours respectfully,

E. D. Coddington.

Milwaukee Bridge and Iron Co.

North Milwaukee, Wis., Dec. 4, 1908.

[While agreeing with the last correspondent as to the possibilities of the evil effect of included clay on the wearing qualities of concrete, an instance of which is noted in the first of the two letters, we must disagree with his theory as to the existence or even the desirability of a porous mass in concrete work. Concrete, made with even moderate care, is not a sponge-like mass through which water diffuses, else the back of a water-retaining wall of concrete would be uniformly moist, a condition that rarely obtains. Rather do some line or lines of weakness show through which the dampness penetrates. Furthermore, even assuming the uniform distribution of moisture through the mass, the variation of the interior temperature with the distance of the mass from the surface creates in cold weather a tendency toward greater expansion into ice of the included moisture near the surface, with the consequent surface cracking so often observed. This is a progressive action toward the center of the mass until finally some weak spot is reached which affords the opportunity for a general breaking down of the structure. If this weak place does not exist, only the surface weathering is observed.

We doubt if the average concrete engineer will accept the statement that it is practically impossible to make concrete under ordinary conditions without "pockets or openings where water will collect, provided the walls forming these pockets are impermeable so that water cannot escape." If the walls are permeable we cannot see what there is to prevent the water running back into the pockets from which it escapes.—Ed.]

United States Bonds for Waterway Improvements.

Sir: As a delegate to the National Rivers' and Harbors' Congress held recently in Washington, the writer desires to answer several of the statements made in your editorial in your Dec. 21 issue, relative to the United States borrowing money for waterway improvements.

In the first place, as to the responsibility of the three thousand delegates present. Is it not true that ours is a government of the people and that popular will is found expressed in legislative acts? Among the delegates present were governors of thirty states, representatives of all the leading cities, boards of trade, representatives of manufacturing, transportation and commercial interests. Every state and territory, including Hawaii and Alaska, was represented. Truly, was not such a Congress national in its composition, and were not the delegates responsible spokesmen of a large proportion of our population?

Few persons, unless they have taken the trouble to investigate the present sentiment of the country with respect to waterway improvements, can deny that there is a strong wave of popular approval sweeping over the country favoring such improvements; this is best shown by the rapid change of front of so many of our legislators on this subject.

The Rivers and Harbors Congress stands for a policy and not for the exploitation of any particular project. Cannot this body request Congress also to adopt some definite policy of comprehensive waterway improvement, rather than to pursue the present plan of dividing the "pork" in such a way that every congressman obtains his slice, without any regard to the merit of his project? The forty or fifty million dollars thus expended by each Congress when spread out over many waterways, some good, some bad and some indifferent, help no section. The writer can cite cases of large expenditures of Government money upon streams that are navigable only in the opinion of the Congressman who seeks his share of the spoils. This is the policy which Speaker Cannon advocates. Is this conservatism? Then let us take a radical step and remove waterway improvements from the field of politics.

It is not the plan of the National Rivers' and Harbors' Congress that the total bond issue of $500,000,000 be made at once, but that $50,000,000, or as much of that amount that can be economically used during the year, together with the present waterways' appropriation, be spent upon projects that would be adopted by the National Waterways Commission as part of the general plan of water ways' improvements.

Now, as to the question of issuing bonds. Has not the Government already committed itself to such a policy in the case of the Panama Canal? Can any one deny that the improvement of our inland waterways is of lesser importance to the welfare of our country than the construction of the Isthmian Canal? The present facilities of our railroads are totally inadequate for handling the volume of business. No less a person than Jas. J. Hill stated at a session of this Congress in December, 1907, that five billion dollars must be expended by the railroads for increasing their facilities to handle the traffic of the country, and in comparison with this amount required to be raised by private corporations, the amount which is asked of Congress seems small indeed. Railroad men are now beginning to realize that waterway improvements will help instead of injure the business of the railroads, serving as feeders to the transcontinental trunk lines and relieving the railroads of a portion of the low class and unprofitable freight.

The writer can see little objection from an economical or an ethical standpoint to borrowing money for permanent improvements. Can it be denied that the creation by the Government of the Appalachian and White Mountain Forest Reserves, which has been demonstrated to be absolutely essential to any plan of permanent river improvement, will not at the same time inure to the benefit of posterity, by the conservation of the vast timber and other resources of these sections?

The conservation of natural resources and waterway improvements are correlated subjects, as any one familiar with our Southern and Western rivers will know, and the endorsement of one movement must necessarily carry with it the endorsement of the other. President Roosevelt, in his speech before the Congress said:

Forests and waterways cannot be separated in any successful treatment of either. Forest protection and river development must go hand in hand.

The writer heard President Roosevelt, President-elect Taft, Vice-President Fairbanks, Representative Champ Clark, Democratic House leader, and other prominent officials advocate most earnestly a bond issue to pay for waterway improvements. Can such men be called irresponsible? No one will question the astuteness and foresighted business judgment of Mr. Andrew Carnegie. This letter can be best concluded by quoting from his speech before this Congress:

I was delighted to hear the President and the President-elect yesterday advocate the issuing of bonds for this great work and to hear Vice-President Fairbanks endorse their sentiments this morning. The policy of issuing bonds needs no more proof. The improvement of our waterways will give back to the country ten-fold the money expended.

Very truly yours,

Francis R. Weller, Assoc. M. Am. Soc. C. E.

Hibbs Bldg., Washington, D. C., Dec. 23, 1908.

[We are fully in accord with our correspondent as to the need of intelligent and expert planning in connection with our Federal waterway improvements and the defects of pres... methods to which he alludes have been ... times pointed out in these columns; but b... making a change let us be sure that the ... will be for the better. It is very risk... ness to open up a huge new conduit for ... the National Treasury and provide no ... valves to keep it from being totally drained.

The man with a hobby, who seeks ... ve you invest a million dollars or fifty milli... llars in an enormously profitable enterprise ... he is promoting, may be a very estimable ... n and may have the greatest confidence in ... success of his own scheme; but if you are ... careful business man you will test thoroughly ... claims and his reliability as an adviser, par... larly if you have to borrow the money and ... rtgage your future in order to invest.

Congressman Ransdell, the Presid... of the Rivers and Harbors Congress, is doub... ss sincere in setting forth the enormous pro... which the United States can make by inv... ting in waterways but as we have shown on our editorial page in this issue, his figures of profit are seen to be absurd as soon as they are critically examined.

Surely the American public cannot safely be guided in making such huge and important investments by the extravagant claims of promotors, who lack the technical knowledge to test the truth of their own statements. As has been well pointed out by President Roosevelt, waterway enterprises should be subjected to critical expert examination by competent engineers and their approval should be first obtained before engaging in any work. And the danger of appropriating a vast sum of money without knowing what it is to be spent for ought to be evident to every thinking man. A half-billion dollars for waterway improvements sounds very attractive; but we ought to be sure it would not turn out a half-billion dollar corruption fund.—Ed.]

Plans for Grade Crossing Removal at Toronto, Ont.

Sir: The Railway Commission of the Dominion of Canada has been hearing the argument of the City of Toronto for further separation of grades in that city, on streets now crossed by the Grand Trunk and Canadian Pacific Railways. A discussion of the best treatment of these crossings has been going on for many years and from time to time reports have been made by engineering experts, some favoring track elevation and some street elevation.

The city is seeking an order from the Railway Commission to compel the railways to raise their tracks along the water front and place them on an elevated structure, this elevation to include not only the running tracks but the local freight yards, freight houses and all team tracks and switch connections.

The structure proposed by the city would be nearly two miles in length and for more than half this distance 16 ft. high and 118 ft. in width. It would be an earth fill between concrete retaining walls, with all crossing streets passing through the structure by subways (as the ground level is only about 5 ft. above high water, the streets cannot be depressed and secure drainage). As an alternative plan the railway companies propose street bridges over the present tracks, two to be built at once and others to be constructed when found to be necessary.

The Grand Trunk and Canadian Pacific Railways lie side by side upon the low-filled lands along the lake front. These low lands are to be extended further into the bay several hundred feet. At present there is a little less than 100 acres of land between the railways and Lake Ontario within the length of the proposed viaduct. The twelve crossing streets in most instances have not been extended beyond the tracks to the water front. The present use of the crossings is comparatively light, excepting at two streets which form the avenues of entrance and exit for the passenger steamers which do a very considerable business in the four or five summer months.

Industrial development along the water front is not great but the present inactivity may be due in some measure to the agitation of the grade crossing problem, as the character of the treatment will largely determine the uses to which the water front may be put. Elevating the main passenger and freight tracks will mean also elevating the switches which would be favorable for the coal business but unfavorable for most of the industries and for traffic between lake and rail.

The cost of the proposed viaduct is estimated by the engineers employed by the city to be about $3,6..,000, but the engineers of the railways say it will cost nearer $6,000,000. The cost of street bridges is estimated at from $150,000 to $200,000 each. In neither plan was

any attempt made to arrive at an estimate of consequential damage and all discussion of this phase of the subject was omitted at the hearing and its consideration left to the Commission.

The opponents claim that the viaduct will cause unfavorable business changes, removal of industries, increased difficulties of operation and will practically prohibit expansion of their facilities. They also urge the difficulty of adjusting relations between the proposed new elevation and the plans which were being adopted for a new union station. The city, on the other hand, claims that the railways will be benefited by the elevation, providing for freer running of trains and that the greatest safety and convenience will be secured to the people in going to and from the water front.

The hearing which closed Friday, Dec. 18, lasted two weeks. The case was presented by able legal counsel on both sides, assisted by a large number of engineers. The hearing was conducted without invoking the rules of evidence and a very free and open discussion was had, the chairman of the Commission stating his earnest desire to secure full and complete information upon all points. Testimony regarding grade elimination in many other cities was given, water front terminals at Chicago especially presenting somewhat similar conditions. Mr. E. B. Guthrie, Engineer of the Buffalo Grade Crossing Commission, described the work at Buffalo and advocated street elevation for Toronto.

The Toronto problem is complicated somewhat by considerations of the future, which could only be lightly touched upon at this hearing. The large questions of the separation of passenger and freight tracks and that of the location of the union station have an important bearing upon the selection of the method of grade crossing elimination. The business of Toronto is moving away from the water front and the city is growing rapidly to the northward.

The Canadian Pacific Railway has now a line over which it sends its through freight, about two miles to the north of the present passenger terminals. It reaches the water front by a loop around the city which involves an additional movement for through passenger trains of four miles and overcoming about 300 ft. of elevation. The Grand Trunk Railway also makes a considerable detour from a direct line to reach the passenger station, and it also has considerable grades to overcome in passing through its Toronto terminal.

The engineers in consultation for the city of Toronto were W. E. Tye, former Chief Engineer, Canadian Pacific Ry., and Isham Randolph, late Chief Engineer of the Chicago Drainage Canal. There appeared for the railways, Chief Engineer H. G. Kelley for the Grand Trunk and J. G. Sullivan for the Canadian Pacific, and also Messrs. C. W. Buchholz of New York and George A. Ricker of Buffalo.

Yours very truly, "Viaduct."

Toronto, Dec. 21, 1908.

Cab Signals vs. Fixed Signals for Railways.

Sir: In your issue of Oct. 29, p. 465, you published the report of the Automatic Stop and Cab Signal Committee of the Railway Signal Association, a report which contains gross contradictions of some facts and which at least obscurely states some others. Since these facts are such as directly and strongly affect the question whether any cab signal now obtainable would, if adopted, render possible a material increase of safety to lives and property entrusted to the care of railroads, it is of the highest public importance that such facts should not be either denied or set forth in such a manner as easily to mislead persons who possess fair intelligence and discernment but whose education and experience have proceeded exclusively along non-signaling lines. Especially important is it that such statements as to signaling be corrected when, as in this case, they are the very faulty utterances of such a body as a committee of the Railway Signal Association.

The Committee's report says: "The automatic stop and cab signal should be considered only as adjuncts to a fixed signal system." Permit me most emphatically to contradict this grossly incorrect statement. Let us turn to the proposition to which the Committee's own note on this point refers and which, when *correctly* stated, shows the Committee's assertion just quoted to be clearly and radically wrong.

The Committee, in its explanatory note here, says (1) that there is an "impossibility of properly checking the work of the engineman if a cab signal or automatic stop is used without a fixed signal." Before citing proof of the incorrectness of this part of the Committee's explanatory note, permit me to first prove that what the Committee wrongly alleges to be a weakness of the cab signal is in fact a weakness of fixed signal systems. For if any given fault is present in the first of the two species contrasted, its presence in the second could not of itself be a reason for rejecting either species for the other.

The following succession of signal intervals, in units of a mile, is taken from a drawing lying before me and showing the signals on part of the main line of the Michigan Central Railroad: 1, 1½, 1¼, 1¼, ¾, a little more than 1¼, a little less than ¾, a little more than 1¼, and a little less than ¾. Your issue of March 7, 1907, says that fixed block signaling for the Boston & Maine was then under construction or contracted for, covering 1,145 miles of track and that (p. 256) "the average approximate length of the blocks is 4,000 ft., but it is intended to shorten the length where traffic is dense, while after the suburban districts have been passed the blocks will be lengthened." Another pertinent fact in this connection is given by the Railroad Age-Gazette which, in an editorial relating to the air brake and appearing under date of Dec. 4, 1908, p. 1466, refers to "faster schedules, requiring speeds of 70 and 80 miles per hour." One is, then, safely within speed limits when he says that trains frequently run at 60 miles per hour.

Assuming this perfectly safe speed figure, we are forced to conclude that, in order to observe fixed block signals, Michigan Central conductors and brakemen, while running over the main track section just mentioned, would have to neglect duties reasonably devolving upon them and be at windows (or, worse still, be at open vestibule doors when windows are coated with frost) at the following successive time intervals: 60 seconds, 90 seconds, 75 seconds, 75 seconds, 45 seconds, a little more than 75 seconds, a little less than 45 seconds, a little more than 75 seconds, a little less than 45 seconds; while Boston & Maine conductors and brakemen would have to read block signals at average intervals of less than about 40 seconds. And the conditions just cited as applying to these two roads are by no means exceptional, but are fairly representative of practically universal block signal conditions.

Why not frankly admit the plain truth, which is that, in such cases as those just adduced, Boston & Maine and Michigan Central conductors and brakemen not only *do not observe fixed block signals* now being given their trains while running, but *cannot do so*! Since the fireman can see a signal placed in his cab at least as easily as he can one in the air and towards which he is running at high speed, and since audible cab signals that obey all practical signal requirements are now obtainable, while audible fixed signals that obey such requirements do not exist, it is clear that, by the important criterion of checking enginemen, the cab signal could not rightly be considered as a mere adjunct to fixed signals, even if the Committee's statement, as to impossibility of such checking with cab systems alone, were correct—which it most certainly is not.

In one cab system mentioned below, a danger whistle is held mute by devices electrically connected in series with those that hold the visual signal in the cab at clear. When current in the visual-signal circuit ceases—either in the normal operation of the system or by reason of failure of electric source or breakage of parts—not only does the visual signal go to danger by gravity, but the whistle valve opens, also by gravity, giving an audible danger signal. So far as firemen are concerned, which system, then, affords a really practical universal check—the fixed system, in which the fireman must be at an open window and have his gaze directed up in the air throughout the whole run, or miss some signals; or the cab system, in which he always knows when an adverse (distant or home) signal is given his train, no matter where he is looking nor what duty he is performing at the time such adverse signal is given.

Space forbids my dealing in the way I should like with the second, and minor, of the two propositions that the Committee gives as its basis for its incorrect statement as to cab systems being merely accessory. I think it would be exceedingly easy to show that this minor proposition offers no serious practical objection to the cab signal as a basic rather than a merely adjunct signaling system.

One of the Committee's classes of cab systems is that in which "insulated engine parts" are used. United States letters patent No. 823,513, of June 19, 1906, describe a system that can be used either for cab signaling only, for automatic slowdown-and-stop purposes only, or for both the signal and the speed-control purposes named. In this system a pair of the regular engine or tender wheels, if insulated, can be used to furnish communication between track and train, though, as is explained in the patent specification, it is not necessary to use any such wheels for this purpose. As this particular cab system, if installed in either way, is free from all the faults characterizing all of the Committee's other classes, and, if installed in a certain one of those ways, will constitute a case entirely within this one of the Committee's classes, the Committee is most clearly wrong in asserting that this class fails to fulfill certain requirements which this system perfectly fulfills. On this point the Committee says, "These systems, it has been found, do not conform to essential requirements Nos. 1, 2, 3 and 11."

Without saying anything pro or con as to the Committee's statement that this class of systems fails to comply with that part of requirement No. 1 which relates to automatic stops, I wish to say that the cab signal described and claimed in this patent conforms to everything demanded of cab signals in both this requirement and in the explanatory note which the Committee appends thereto.

While the object of this communication is to deal with the cab signal and not with the automatic stop, I wish to digress from that object sufficiently to brand as glaringly wrong the Committee's assertion that "these systems" fail to conform to the automatic stop specification which constitutes the Committee's requirement No. 3.

In considering the Committee's statement that this same class of cab systems does not conform to requirements Nos. 2 and 11, it should be borne in mind that these requirements have absolutely nothing to do with cab signals, but are exclusively automatic stop specifications.

Wm. H. Dammond.

Detroit, Mich., Dec. 10, 1908.

Notes and Queries.

Attention has been drawn to two typographical errors in Table II. accompanying the article "Test of Four 35,000,000-Gal. Centrifugal Pumping Units at Pittsburg," in our issue of Nov. 26. In the first column the item "Suction head, plus distance between gages (22 ins.), ft." should be followed by 15.47 instead of 16.47 as printed. The error is evident by checking the total head (52.97) and the mercury column (12.05 ins. = 13.64). In the next to the last line the true reading should be "Duty—ft.-lbs. per 1,000 lbs. of steam." This is evident from the text of the article.

THE MASSACHUSETTS STATE BOARD OF HEALTH ON POLLUTION OF BOSTON HARBOR FROM THE MOON ISLAND OUTLET OF THE BOSTON SEWERAGE SYSTEM.

In view of the frequent references to the effect of the Moon Island outlet of the Boston sewerage system upon the waters of Boston Harbor, made at the hearing on the proposed Passaic Valley outlet into New York Harbor on Dec. 9 and 10, 1908, a report on the subject recently made by the Massachusetts State Board of Health is of considerable interest. It appears from the annual report of the Massachusetts State Board of Health for 1906-07, which has just been issued, that the board was ordered by the Legislature of 1907 to report not later than Jan. 15, 1908, "as the best means of preventing the further pollution of Boston Harbor by the discharge of foul sewage at Moon Island." The report made in accordance with this order follows:

The sewage discharged at the Moon Island outlet is that which is collected by the main drainage system of the city of Boston. In character it is not essentially different from that of other cities, except for a slight admixture of salt water which leaks into the sewers located near the shores of the harbor and its estuaries, through tide gates and in other ways. It becomes somewhat decomposed in its passage through the deposit sewers, the tunnel, and especially the reservoirs at Moon Island, in which it is stored for several hours in order to admit of its discharge only in the second and third hours of the outgoing tide, when the currents are most favorable for its speedy removal and dilution with a large volume of sea water; but at the time of its discharge it is not noticeably more offensive than the sewage of other cities and towns stored in reservoirs for convenience in disposal.

The Boston main drainage works were completed and the outlet at Moon Island first used in 1884. The quantity of sewage discharged there gradually increased for many years, owing to the growth of the city and the extension of sewers into metropolitan areas adjacent thereto, chiefly in the Charles and Neponset river valleys. The quantity of sewage delivered at Moon Island eventually became so great that the reservoir capacity became unequal to the storage of all the sewage for a sufficient length of time to allow for its discharge in the two most favorable hours of the outgoing tide; but in 1899 the capacity of the reservoirs was doubled, and the necessity for discharging considerable quantities of sewage at unfavorable times was removed. In 1904 the quantity of sewage delivered at this outlet was greatly reduced by the completion of the high-level sewer and the diversion of all of the sewage of the Charles and Neponset river valleys into the high-level system, which has a separate outlet at Peddocks Island. In subsequent years the sewage of other considerable areas has been connected with the high-level system, and, while no satisfactory records of the quantity of sewage discharged at Moon Island are available, the quantity discharged at Peddocks Island—all of which has been diverted from the Moon Island outlet within the past three years—amounted during the year 1906 to 33,600,000 gals. per day. It is probable that the quantity of sewage discharged at Moon Island at the present time is considerably less than 100,000,000 gals. per day.

In the summer of 1905, after the quantity of sewage discharged at Moon Island had been reduced by the diversion of the sewage of the Charles and Neponset river

valleys into the high-level system, an investigation was made by this board to determine the condition of the water of Boston Harbor and the effect of the discharge of sewage therein. This investigation showed that the quantity of free ammonia present in the waters of the inner harbor—i. e., inside or west of a line drawn from the easterly end of East Boston to South Boston—was greater on the outgoing tide than anywhere in the region of the harbor about Moon Island, excepting in the narrow path taken by the sewage in passing from Moon Island to the sea and within 2½ miles of Moon Island. On the incoming tide the quantity of free ammonia found in the water of the inner harbor was greater than was found anywhere in the region about Moon Island, excepting immediately about the sewer outlet itself.

The same is true of the results of bacterial examination. On the outgoing tide the number of bacteria was higher in the inner harbor than anywhere about Moon Island, excepting in the immediate track of the sewage and within 2½ miles of the outlet. On the incoming tide the number of bacteria was greater in the inner harbor than anywhere in the neighborhood of Moon Island, excepting immediately about the outlet.

Other examinations were made to determine more definitely the area affected by the discharge of sewage at the Moon Island outlet, and samples of water were collected for analysis from numerous stations for a long distance about this outlet. The results confirm those of the previous investigations, showing that the effect of the sewage discharged at the Moon Island outlet upon the harbor water is markedly noticeable only in a restricted area extending from the outlet along the path taken by the sewage toward the sea, and that outside of this area, which at its greatest extension does not exceed 2½ miles in length by ⅛ to ¾-mile in width, and then only during the outgoing tide—the period when the sewage is discharged—is the water noticeably more polluted, as shown by chemical or bacterial analysis, than the water in the inner harbor.

An examination of the outlet at Moon Island in August, 1907, and observations of the discharge of sewage there, indicate that the works at that point are well cared for, and the times of discharge strictly adhered to by the officer in charge of that work.

While the order of the Legislature does not appear to have been intended to include the main sewer outlets at Deer Island and at Peddocks Island, the board would add that the sewage from those outlets—which is discharged in smaller quantities and also continuously at all stages of the tide, and hence in a very much smaller volume than at Moon Island—has a much less noticeable effect upon the harbor water than that discharged at Moon Island during the few hours immediately after it is discharged there.

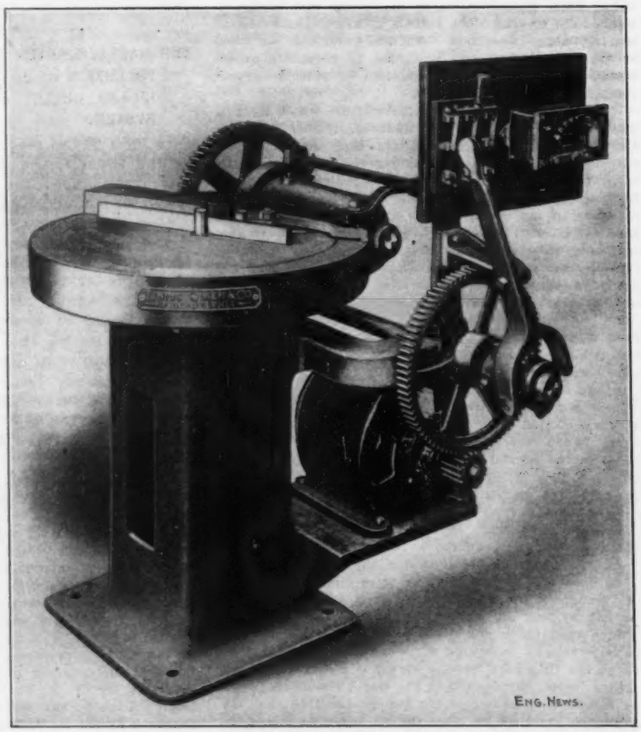
In view of the fact that the waters of the inner harbor of Boston show more evidence of pollution than the waters of the outer harbor, excepting in the neighborhood of the main sewer outlets and in the immediate track of the sewage from Moon Island after it has been discharged and is on its way to sea, and in view of the results of observations of the board showing that the pollution of the inner harbor is not due to the discharge of sewage at Moon Island or at either of the other main outlets, the board sees no present necessity for the adoption of means for the prevention of the further pollution of the harbor by the discharge of sewage at Moon Island or at either of the other main outlets.

REINFORCED-CONCRETE TIES have been in use for several years on the Italian State Railways, and the railway administration is said to have placed a contract recently for 300,000 of these ties. The cost is about $1.25 per tie, and the life is said to be three or four times that of the wooden ties. One tie in every thousand will be broken, and investigation made as to the character of the concrete and its bonding with the steel. The manufacturers are also required to guarantee the ties for one year, replacing all those which fail in that time.

A COLD-BEND TESTING MACHINE.*

The special testing machine, shown in the accompanying figure, is designed for the cold bending of iron and steel specimens as required by many manufacturers. With this machine, it is claimed that only three minutes is required to bend a specimen 180° around a pin. It is expected that this saving of time over the use of the old tension machines, with special fittings, will be of advantage in mills where many tests of this kind are necessary.

The machine is designed to bend specimens up to 1 sq. in. in cross section. The sample is bent around a pin of a diameter equal to its own thickness. Pins up to 2 ins. in diameter are provided, the smaller sizes being specially shaped to withstand the bending loads that may come upon them. These pins have taper shanks and the socket is fitted with a knockout pin to facilitate quick change. The bending pin may be placed at such distance from the center as is desirable. A taper liner, shown at the back of the specimen, allows adjustment for the various sizes of specimens to be tested. The outer edge of the table is graduated in 5° points to allow the reading of any desired angle of bending.



A COLD BENDING MACHINE FOR IRON AND STEEL.
Made by Tinius Olsen & Co., Philadelphia.

As marketed, the machines are equipped with a direct-current drive designed by the Westinghouse Electric and Manufacturing Co. A 1.25-HP. motor is mounted on a rear bracket and drives the table through a clutch and gear train. The machine is intended to be operated by means of the clutch handle, but an automatic stop is provided to throw out the motor switch on the end of the return travel of the table, should the operator neglect to work the clutch control. The return travel of the table is accomplished by reversing the motor, for which action a double-throw switch is provided.

The machine is made by Tinius Olsen & Co., Philadelphia.

*From information furnished by the Westinghouse Companies Publishing Department, Pittsburg, Pa.

NOTES FROM ENGINEERING SCHOOLS.

UNIVERSITY OF MICHIGAN.—An addition is to be made to the new Engineering Building in the form of a wing, 60 ft. by 130 ft., and four stories high. It will be placed at the north end of the naval tank, which at present extends about 50 ft. beyond the rest of the building in that direction, and will be connected with the main structure by an extension over the tank.

A new site for the summer camp of civil engineering students has been presented to the University by Col. and Mrs. Chas. C. Yeardus, of Pellston, Mich. It comprises 1,500 acres of land in Cheboygan County, with nearly three miles of shore line upon Douglas Lake. The land is of rolling character rising about 60 above the lake a short distance back from the comparatively low shore.

A new reflecting telescope is to be added to the equipment of the observatory. It will have a 37⅝-in. parabolic mirror, and the equivalent focal length in spectroscopic work will be 60 ft., placing it in this respect midway between the Lick and Yerkes refractors. The mirror and most of the working parts of the telescope, with the exception of the tube, are already constructed. The telescope will be mounted in a brick tower 40 ft. in diameter with a copper-covered steel dome rising 68 ft. above the tower basement. In the basement of the two-story addition, 112 ft. long and 44 ft. wide, which will connect the new dome with the present observatory, will be installed a complete set of seismographic instruments.

RAILWAY ACCIDENTS occurring Dec. 24 and 25 resulted in the death of three people and the injury of 22 others. The water gage burst in the cab of a locomotive drawing a train on the Lake Shore & Michigan Southern Ry. Dec. 24 and indirectly caused the death of a brakeman and fireman who were in the cab. The accident occurred two miles west of La Porte, Ind. The men evidently feared the boiler was about to explode and jumped from the engine, which was running at about 50 mi. per hr.

A passenger train on the Lake Shore & Michigan Southern Ry., southbound on the branch between Jackson, Mich., and Fort Wayne, Ind., was wrecked Dec. 24, 1½ miles north of Pleasant Lake, Ind. Sixteen persons were injured. The accident is ascribed to a broken flange which caused the train to jump a switch and run in on the siding to a gravel pit. The locomotive buried itself in the gravel and several coaches were upset.

An accident on the New York, New Haven & Hartford R. R. in the yards at Springfield, Mass., Dec. 24, caused the death of a brakeman and delayed traffic for several hours. The first section of the train leaving New York City at noon was to go no further than Springfield and was being backed to a siding when a mistake in switching caused it to collide with the third section of the train, which was just passing through the yards. The third section "sidewiped" the rear car of the first section, overturning it and killing the brakeman who was on the rear platform. Only one car of the third section was involved in the collision and this one was but slightly damaged.

A head-on collision took place on the Great Northern Ry. Dec. 25 near Elmira, Idaho, between a local passenger train and an extra freight train. One man was killed and four injured.

A RAILWAY STATION WAS WRECKED on the Buffalo & Susquehanna Ry., at Addison, N. Y., Dec. 24. A freight train of 72 cars broke away from its locomotive on a steep grade five miles from Addison. Upon reaching the Addison station they had attained a considerable speed and jumped the track, demolishing the station and the buildings of the Howell Creamery Co. The wreckage of the cars and creamery caught fire and was completely burned, together with a number of passenger coaches on a nearby siding. Only one man was injured.

AN EXPLOSION IN A COAL MINE at Lick Branch, Va., Dec. 29 entombed 50 miners. Reports state that 14 of these men have been taken out of the mine but that four of them were dead when found.

AN ACCIDENT TO THE HOISTING CABLE in the 240-ft. shaft of the Columbus mine, near Cobalt, Ont., Dec. 24, resulted in the death of three miners. The cable is said to have slipped from its wheel while the bucket was descending the shaft.

THE CAVING-IN OF A TRENCH at the blast-furnace plant at Ensley, Ala., Dec. 28 killed ten laborers and injured several others, including two foremen who were superintending the work. The trench was being made to hold a large gas flue from the blast furnaces to a new battery of boilers. The brick work at the end of the 4-ft. main was broken open by the cave-in and gas flowed from this opening into the trench, making it difficult to recover the bodies.

ONE OF THE GREATEST CATASTROPHES since the dawn of history occurred in southern Italy on Dec. 28. An earthquake shock and tidal wave, centering about the narrow straits of Messina, which separates the Island of Sicily from the mainland, overthrew the cities of Reggio on the north side of the Straits and Messina on the south as well as numerous adjacent villages. Only vague estimates are as yet possible of the total number killed, but reports place it as high as 100,000. Messina, the larger city affected, had a population of 90,000 and is said to be two-thirds destroyed by the earthquake, the tidal wave and the fire which followed the earth shock. The earth vibration was recorded by seismographs all over the globe. The Straits of Messina are especially subject to earth tremors and the cities of Messina and Reggio in 1783 lost a large part of their population in an earthquake.

AN EXPLOSION OF POWDER at the plant of the American Powder Mills Co., at South Acton, Mass., Dec. 24, wrecked the glaze mill and destroyed 10,000 lbs. of powder. No lives were lost. The jar due to the explosion is said to have been distinctly felt at a distance of 40 miles.

THE BOARD OF ENGINEERS to accompany President-elect Taft on his coming visit to the Panama Canal works has just been appointed by President Roosevelt. The members of the board will be Messrs. Arthur P. Davis, Chief Engineer of the U. S. Reclamation Service; John R. Freeman, Providence, R. I.; Allen Hazen, New York City; Isham Randolph, Chicago; James Dix Schuyler, Los Angeles, Cal., and Frederic P. Stearns, Boston, Mass.

AMERICAN DIESEL ENGINE CO.—The recent publication of a notice of involuntary bankruptcy proceedings against this company has occasioned some question as to the effect of the engineering work of the company on the trouble. Col. E. D. Meier, M. Am. Soc. M. E., Secretary of the company, in response to an enquiry, stated that the embarrassment was entirely caused by the defects of the commercial organization and had no engineering significance. The engine as developed and improved for the American market was held to be a complete success, but the business organization had been found inadequate to make the building and marketing of the American type of Diesel engine sufficiently profitable, in spite of the merits of the engine. These engines it was said had been installed in this country in units aggregating 28,000 HP. capacity and in each case operation had been found highly satisfactory. A guarantee of 8 gals. of fuel oil per 100 HP.-hr. had been met in every case and usually with a margin of 10 to 25%. Several units are normally running on 6.2 gals. per 100 HP.-hrs., under commercial conditions. No trouble is experienced in starting the engines from compressed air stored in "bottles" which are filled from the injection system. It is now conceded that only a second-rate operator would fail to start a cold engine on a single air charge and bring it up to full load in about one minute. This facility in handling the Diesel engine had caused the company some time since to cease publishing the old "air cards" or further data on the operation of the engine in the starting period. The operation of Diesel engines on French submarines and on the tenders of the "Dreadnought," it was said, opened up a field which it was hoped to also exploit in America.

A reorganization is likely to be arranged at the meeting of the creditors which will be held in the near future.

MINE RESCUE STATIONS, to teach miners and mine bosses the most approved methods in mine rescue work, are to be established by the United States Government in the various coal districts of this country. These stations, nine of which are now anticipated, are not only to be instruction headquarters but are also to contain rescue apparatus which may be immediately called into service in case of mine accidents in the district. There will be a station at the University of Illinois for the Middle States fields, one at Raton, N. M., at South McAlester, Okla., and at the University of Tennessee, at Knoxville. The other locations have not been decided upon.

AN INTERNATIONAL CONSERVATION CONFERENCE covering North America has been called by President Roosevelt to meet in Washington on Feb. 18. Formal invitations have been sent to the Governments of Canada and Mexico.

THE SOUTH DAKOTA STATE CONSERVATION COMMISSION, appointed by the Governor last fall, has made a preliminary report with recommendations which are summarized as follows.

1. Conservation of the soil.

Make the wilful waste of the fertility of the soil a public offense with heavy penalties.

Provide for the education of the people upon the most approved methods of agriculture, having in view the preservation of the fertility of the soil, in the public schools, in farmers' institutes and through the public press.

Encourage the application of dry farming methods in agriculture, through the experimental stations and in the farmers' institutes.

2. Conservation of the water resources.

By strict regulation of the boring, flow and use of the artesian waters.

By impounding the flood waters in draws and valleys.

3. Preservation of our natural forests and encouragement of forestry.

Our natural forests are chiefly within the national forest reserves, and are receiving the careful attention of the national government. Such forests as are so protected should be carefully guarded by the laws of the state and especially should there be enforced rigorous penalties for the setting of forest fires.

Tree planting should be encouraged by every proper means.

4. Preservation of the coal mines for the use of the people.

Prompt action should be taken by the state and nation to prevent the coal measures of the state from passing into the hands of private monopolies, and such regulations be adopted as will preserve the great gift of nature for the benefit of the public.

Mr. S. H. Lea, State Engineer, is one of the members of the Commission.

CARBON MONOXIDE FROM A WATER HEATER is assigned by a coroner's jury as the cause of another death in Washington, D. C. The victim in this case was found dead in the bath-tub with the heater in operation in the same room. An autopsy is said to have proved conclusively that his death was due to gas poisoning.

A NEW FREIGHT SUBWAY SYSTEM FOR NEW York City is proposed by Mr. D. D. McBean, who was one of the contractors for the subway tunnels under the Harlem River. Mr. McBean proposes to build tunnels and subways of a size sufficient to accommodate regular railway cars and bring the passenger trains of the railways now terminating on the west side of the North River into a union passenger station, in the Borough of Manhattan, located at the site bounded by Park Row, Oliver St. and Pearl St. In addition, he would build a system of combined railroad and roadway subways of sufficient size and width to provide for a roadway 22 ft. wide for automobile and team trucking, and in addition two to three railway tracks. The scheme was brought to the attention of the Public Service Commission on Dec. 11.

A FORESTRY COMMISSION FOR VERMONT is provided for by a legislative bill just approved by the Governor of that State. There will be a commission of five members, including the Governor and the Director of the Experiment Station (Prof. Joseph L. Hills, Burlington, Vt.). The members of the commission will serve without pay, but the bill authorizes the employment of a forester at a salary of not over $2,500 a year. The commission is authorized to accept or buy waste lands for forestry purposes, but the information at hand does not indicate what appropriation, if any, has been made for the purchase of such lands.

WATER AND WATER-POWER DIVERSION is to be investigated by a committee of the New England Water Works Association, of which Mr. Leonard Metcalf, M. Am. Soc. C. E. (14 Beacon St., Boston, Mass.), is secretary. The committee has drawn up a blank form including 29 questions, which it is sending out for collecting information on the subject.

THE POSSIBILITIES OF A BRIDGE OVER THE Hudson River to carry the Catskill Aqueduct, now under construction by the Board of Water Supply, City of New York, have been investigated on behalf of the Board. Inasmuch as some of the daily papers of New York City made it appear that there was considerable probability of the construction of such a bridge, it seems advisable to put on record the fact that the only thing seriously contemplated thus far has been the ascertainment of the feasibility and cost of such a means of getting the aqueduct across the river, in comparison with other means of crossing the stream. As was shown at some length in our issue of April 2, 1908, explorations for a tunnel crossing of the Hudson near Storm King Mountain were begun some time ago. Studies have also been made of the possibilities of crossing the river by means of submerged pipe lines, as well as by the tunnel and bridge. It has been found that at the two or three locations considered, the only type of bridge which could be built would be a suspension bridge. A single-span suspension bridge, with piers on such rock foundations as have thus far been found to exist for a certainty, would have a span considerably in excess of any suspension bridge yet built. A bridge of more than one span would of course involve very considerable difficulties in securing pier foundations, even if authority to put piers in the river could be secured from the United States. There is still every reason to believe, we judge from the information at hand, that a satisfactory tunnel crossing can be secured at the proposed Storm King line, and that such a crossing would cost much less and be in many respects far less difficult than any other crossing that could be devised.

THE FITNESS OF RAILWAY EMPLOYEES in New York State is being investigated by the Public Service Commission of the Second District. Reports made to the Commission indicate that a large proportion of all accidents on steam railways during the past year have been due to the failure of employees to obey operating rules or special orders relating to train movement. The nature of the investigation is brought out by the following order issued by the Commission:

That each and every operating steam railway corporation under the supervision of the Commission be required to furnish and report to the Commission, on or before Feb. 1, 1909, the following papers and information:

1. Five copies of all printed rules for the operation of the road.

2. A statement showing for each of the following classes of employees engaged in the operation of its road, namely: Engineers, firemen, conductors, trainmen, flagmen, brakemen, switch tenders, gatemen at crossings, flagmen at crossings, towermen, telegraph operators, train dispatchers, or any other employees engaged in operating trains, what examination or inquiry, if any, is made previous to their employment in or promotion to such positions, as to their mental and physical capacity, experience and general fitness for the proposed employment.

3. A statement showing what steps are taken to require of each employee a competent knowledge of the operating rules governing his duties and conduct as such employee.

4. A statement showing what examinations or investigations are made from time to time, either regularly or otherwise, to keep informed as to whether employees of the said classes are familiar with the rules and instructions governing their duties and conduct, and what measures are taken to improve the effectiveness of operating rules from time to time, and their applicability to disclose accident situations.

5. What record, if any, is kept of violations of rules and instructions by any of the aforesaid employees.

6. Any other information which may, in the opinion of the chief operating officer of each of said corporations, be of use to the Commission in investigating the causes of accidents so far as such accidents arise from neglect or non-observance of rules and instructions by employees.

CHARGES FOR ELECTRIC SERVICE.—The Public Service Commission for the First District of New York has issued an order forbidding discrimination in charges to different customers in the same classes. This order is the result of an investigation into electric service in the metropolitan district, conducted by Commissioner Milo R. Maltbie during the year past, and reads as follows:

Section. 1. No electrical corporation shall directly or indirectly, by any special rate, rebate, drawback, or other device or method, charge, demand, collect or receive from any person or corporation a greater or less compensation for electricity or any service rendered or to be rendered, than it charges, demands, collects or receives from any other person or corporation for doing a like and contemporaneous service with respect thereto under the same or substantially similar circumstances or conditions.

Section. 2. No electrical corporation shall make or give any undue or unreasonable preference or advantage to any person or corporation, or to any locality, or to any particular description of service in any respect whatsoever; or subject any particular person or corporation or locality or any particular description of service to any prejudice or disadvantage in any respect whatsoever; but nothing in this section shall be construed as applicable to contracts with or service rendered to the City or State of New York.

Sections 3. No electrical corporation shall charge, demand, collect or receive a greater or less or different compensation for supplying electricity for light, heat or power, or for any service rendered, than the rates and charges applicable to such service as specified in its schedules filed with the Public Service Commission and posted and in effect at the time; nor shall any electrical corporation refund or remit in any manner or by any device any portion of the rates or charges so specified; nor extend to any person or corporation any privileges or facilities in connection with such service, except such as are regularly and uniformly extended to all persons and corporations under the same or substantially similar circumstances or conditions.

Section 4. No electrical corporation, or any officer or agent thereof or any person acting for or employed by it, shall assist any person or corporation to obtain electricity for light, heat or power or to obtain any service at less than the rates then established and in force in accordance with the schedules filed with the Public Service Commission for the First District and published in accordance with the order of the said Commission.

Section 5. This order shall take effect at once and shall continue in force until abrogated or modified by the Commission.

Section 6. Every electrical corporation hereby affected shall notify the Public Service Commission for the First District, on or before December 26, 1908, whether the terms of this order are accepted and will be obeyed.

It is obviously intended that the words "for doing a like and contemporaneous service" shall allow a reasonable classification of consumers though restricting discrimination between members of the same class.

A BASCULE BRIDGE of the Scherzer rolling-lift type has been completed recently in Burma. It crosses the Ngawun River and carries the Rangoon-Kyngin extension of the Burma Railways. The bridge is 820 ft. long. It has four fixed truss spans and a double-leaf bascule 220 ft. long, which gives a clear channel opening of 200 ft. between the piers. All the spans have through trusses. The bridge was designed by the Scherzer Rolling-Lift Bridge Co., of Chicago, and was erected under the charge of its engineers. The material was manufactured by Spencer & Co., of Melksham, England.

PERSONALS.

Mr. E. R. Lilienthal has become President of the Northern Electric Ry., succeeding Henry A. Butters, deceased.

Mr. W. C. Brown will become President of the New York Central & Hudson River R. R. Feb. 1, succeeding Mr. W. H. Newman, resigned.

Mr. A. O. Van Suetendael, Assoc. M. Am. Soc. C. E., has been appointed Structural Engineer in the office of the State Architect at Albany, N. Y.

Mr. Frederick W. Ridley has become Superintendent of the Calumet & Hecla Copper Mine, succeeding Mr. Walter Fitch, M. Am. Inst. M. E., resigned.

Mr. John G. Walber has been appointed General Superintendent of Transportation of the Baltimore & Ohio R. R., succeeding Mr. Arthur Hale, resigned.

Mr. George P. Smith, Chief Engineer of the Lake Erie & Western R. R., has been appointed Chief Engineer of the Cleveland, Cincinnati, Chicago & St. Louis Ry., succeeding Mr. William M. Duane, resigned.

Mr. J. H. Milton, General Foreman of the Car Department of the Chicago & Alton R. R. shops at Bloomington, Ill., has been appointed to a similar position with the Chicago, Rock Island & Pacific Ry. at Shawnee, Okla.

Mr. Ernest R. Bissell, Superintendent of the Ft. Wayne, Cincinnati & Louisville division of the Lake Erie & Western R. R., has been made Superintendent of the Western division of the main line with office in Lafayette, Ind.

Mr. John M. G. Watt, M. Am. Soc. C. E., U. S. Assistant Engineer at Chattanooga, Tenn., who is now in charge of the construction of the Hales Bar lock and dam on the Tennessee River, has been appointed Assistant Division Engineer on the Panama Canal.

Mr. Lincoln Bush, M. Am. Soc. C. E., whose resignation as Chief Engineer of the Delaware, Lackawanna & Western R. R. was noted in this column Dec. 17, will open an office as a consulting engineer on Jan. 1 in the Metropolitan Life Bldg., New York City.

Mr. R. R. Jamieson, whose resignation as General Superintendent of the Canadian Pacific Ry. at Winnipeg, Man., was noted in this column Oct. 15, has been elected Mayor of the City of Calgary, Alta. A street railway is to be built by this city during the coming year.

Mr. Frank C. Osborn, M. Am. Soc. C. E., President of the Osborn Engineering Co., of Cleveland, Ohio, has been appointed a member of the Cuyahoga County Court-House Commission which has charge of the construction of the new court-house and other county buildings.

Mr. Foster Crowell, M. Am. Soc. C. E., Commissioner of Street Cleaning of New York City, has resigned. He will be succeeded by Mr. William H. Edwards, who was appointed Deputy Commissioner under Commissioner Craven in March, 1907, and became Acting Commissioner shortly afterward during Mr. Craven's illness.

Mr. Walter E. Spear, Assoc. M. Am. Soc. C. E., has been appointed Chief Engineer of the Brooklyn branch of the Department of Water Supply, Gas and Electricity of the City of New York. Mr. John E. McKay, M. Am. Soc. C. E., who has served for two years as Acting Chief Engineer of the Brooklyn branch, has been transferred to Staten Island as Assistant Engineer.

Mr. J. E. Woodwell, Assoc. Am. Inst. E. E., of the firm of L. B. Marks & J. E. Woodwell, New York City, has been chosen as Consulting Engineer for the entire mechanical and electrical equipment of the new U. S. Post-Office to be erected at the Pennsylvania Terminal station in New York City. Prof. S. H. Woodbridge, of the Massachusetts Institute of Technology, will be Associate Consulting Engineer for the heating and ventilation of this building.

Rear-Admiral John K. Barton, U. S. Navy, Chief of the Bureau of Steam Engineering, has been placed on the retired list for disability, at his own request. He was appointed a cadet engineer in 1871, graduated at the Naval Academy in 1873 and reached the rank of captain in July, 1907. He became Chief of the Bureau of Steam Engineering in June, 1908. It has been decided to merge this bureau with the Bureau of Construction and no new chief will be appointed to succeed Admiral Barton.

Appointments are announced by Mr. Frank M. Williams, recently elected State Engineer and Surveyor of New York, as follows:

Mr. H. E. Breed, Assoc. M. Am. Soc. C. E., has been appointed Auditor in the Department of the State Engineer.

Mr. Guy V. Moulton, M. Am. Soc. C. E., Resident Engineer at Syracuse, has been appointed Division Engineer of the middle division.

Mr. George B. Williams has been appointed Division Engineer of the eastern division. Mr. Williams was born at Durhamville, N. Y., in 1875 and graduated at Colgate University in 1895. He became a rodman in the Department of the State Engineer of New York in 1896 and continued in this department until 1898, when he was employed by the U. S. Board of Engineers on Deep Waterways on the surveys for a ship canal from the Great Lakes to the Atlantic Ocean. After the completion of this work in 1900, he returned to the Department of the State Engineer as an assistant engineer. He remained in this position until 1907 when he resigned to take charge of surveys and construction work for the Syracuse Intercepting Sewer Board.

Mr. Thomas W. Barrally, M. Am Soc. C. E., has been appointed Division Engineer of the western division. Mr. Barrally is a graduate of Union College, Schenectady, N. Y. In 1888 and '89, he served as a rodman in the Engineer Corps of the Long Island R. R. During the next two years he was Assistant Engineer on the construction of the White Plains, N. Y., sewerage system, under Mr. W. B. Landreth, and of the Port Chester, N. Y., sewerage system. From 1891 to 1900 he was City Engineer of North Tonawanda, N. Y., and a member of the firm of Barrally & Snow, Civil Engineers. In 1900 he entered the service of the Department of the State Engineer and since 1904 has been Resident Engineer of the barge canal in charge of residencies extending from Buffalo to Gasport.

Mr. Harry W. De Graff, Assoc. M. Am. Soc. C. E., whose appointment as Deputy State Engineer of New York has been previously recorded in this column, was educated at Hamilton Institute, New York City, and at Union College. He entered the Department of the State Engineer in 1896 as a rodman on the Erie Canal improvement. From 1900 to 1904 he served as Assistant Engineer in charge of highway improvements. From this time until, in 1907, he resigned to engage in private practice, he was Resident Engineer in charge of Section No. 3 of the barge canal.

Mr. William B. Landreth, M. Am. Soc. C. E., who has been appointed Special Deputy Engineer in charge of barge canal work, graduated in the civil engineering course at Union College in 1881. For several years he was employed on railway work in Mexico and the United States and was afterward in charge of sewer construction in various cities and towns in New York and Pennsylvania. He entered the Department of the State Engineer of New York in 1897 and has held the position of Special Resident Engineer since 1903, when he had charge of the $101,000,000 estimate. In this position, he has been in charge of barge canal work under the Special Deputy Engineer and has acted as Engineer-Secretary of the advisory board of consulting engineers. Mr. Landreth is now 51 years old.

Obituary.

George M. Laughlin, for many years President of the Jones & Laughlin Steel Co., died Dec. 11 at his home in Pittsburg, Pa.

Josias J. Henderson, a retired civil engineer and a former member of the firm of Lowthorp & Henderson, of Trenton, N. J., died Dec. 20 at his home in Brooklyn. He was born in Edinburgh, Scotland, in 1837.

Allen F. Gill, formerly City Engineer of Spokane, Wash., was accidentally killed while hunting near Moses Lake, Wash. It is believed that his gun was discharged by catching on a twig while he was dragging it with him through the brush.

Henry W. Caldwell, President of H. W. Caldwell & Son Co., of Chicago, died at Redlands, Cal., Dec. 22. Mr. Caldwell was born in Bath Co., Kentucky, in 1843. He was for several years General Superintendent of the Indiana State Board of Agriculture and was the inventor of the Caldwell conveyor.

George W. West, Superintendent of Motive Power of the New York, Ontario & Western Ry., died Dec. 24 at his home in Middletown, N. Y. Mr. West was born at Troy, N. Y., in 1847 and was educated in the public schools in that city. He entered the shops of the New York Central & Hudson River R. R. at Schenectady in 1865 and was afterward in the employ of the Chenango Valley Ry. and the West Shore R. R. From 1896 to 1900, he was a master mechanic of the Erie R. R. and went from this position to that which he held up to the time of his death. He became a member of the New York Railway Club in 1889 and was President of the club in 1894-5. He was also a member and Past-President of the Central Railway Club.

ENGINEERING SOCIETIES.

COMING MEETINGS.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.
Dec. 28-Jan. 2. Annual meeting at Baltimore, Md. Secy., L. O. Howard, Smithsonian Institution, Washington, D. C.

NATIONAL ASSOCIATION OF CEMENT USERS.
Jan. 11-16. Annual convention at Cleveland, Ohio. Secy., Geo. C. Wright, Harrison Bldg., Philadelphia, Pa.

IOWA ENGINEERING SOCIETY.
Jan. 13-14. Annual convention at Waterloo, Iowa. Secy., A. H. Ford, Iowa City, Iowa.

MICHIGAN ENGINEERING SOCIETY.
Jan. 12-15. Annual convention at Ann Arbor, Mich. Secy., Alba L. Holmes, 574 Wealthy Ave., Grand Rapids, Mich.

INDIANA ENGINEERING SOCIETY.
Jan. 14-16. Annual convention at Indianapolis, Ind. Secy., Charles Brossman, Union Trust Bldg., Indianapolis, Ind.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Jan. 19. Annual meeting at New York City. Secy., W. M. Mackay, P. O. Box 1818, New York City.

WOOD PRESERVERS' ASSOCIATION.
Jan. 19. Annual meeting at Chicago, Ill. Secy., W. Berry, Union Pacific R. R., Topeka, Kan.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 20. Annual meeting at New York City. Secy., Charles W. Hunt, 220 West 57th St., New York City.

OHIO ENGINEERING SOCIETY.
Jan. 26-28. Annual convention at Columbus, Ohio. Secy., Paul Hansen, Harrison Bldg., Columbus, Ohio.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 27-29. Annual meeting at Chicago, Ill. Secy., E. E. R. Tratman, 1636 Monadnock Block, Chicago.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Jan. 28. Annual meeting at Toronto, Secy., H. McLeod, 413 Dorchester St., W., Montreal, P. Q.

NATIONAL BRICK MANUFACTURERS' ASSOCIATION.
Feb. 1-6. Annual convention at Rochester, N. Y. Secy., T. A. Randall, Indianapolis, Ind.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.—At the first annual meeting in Pittsburg, Pa., Dec. 28-29, the following officers were elected: President, Samuel P. Sadtler; Vice-Presidents, Chas. F. McKenna, H. A. Hunicke, Edward S. Acheson; Secretary, John C. Olsen; Treasurer, Wm. A. Booth; Auditor, Richard K. Meade.

ENGINEERS' CLUB OF CINCINNATI.—At the annual meeting Dec. 17 at Cincinnati, Ohio, officers were elected as follows: President, F. M. Crocker; Vice-President, E. H. Berry; Secretary and Treasurer, E. A. Cast; Directors, J. N. Coldwell, J. A. Lilly, H. C. Innes. The membership of the club has increased from 80 to 160 in the last two years.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—The next regular meeting will be held in the auditorium of the Engineering Societies Building, 33 West 39th St., New York City, Jan. 8. Mr. Elihu Thompson, of the General Electric Co., West Lynn, Mass., will present a paper entitled "Conditions Affecting Stability in Electric Lighting Circuits."

ENGINEERS' SOCIETY OF WESTERN NEW YORK.—At the annual meeting held Dec. 12, 1908, at the Buffalo Public Library, Buffalo, N. Y., the following officers were chosen for the ensuing year: William G. Houck, president; Frank V. E. Bardol, Frank N. Speyer, vice-presidents; Leslie J. Bennett, George C. Diehl, John G. Ulman, directors; Thomas J. Rogers, treasurer; William A. Haven, librarian; Elwin G. Speyer, secretary. Several engineers were admitted to membership.

WASHINGTON SOCIETY OF ENGINEERS.—The annual meeting was held at Washington, D. C., Dec. 15, and the following officers were elected for the coming year: President, D. S. Carll; Vice-President, W. A. McFarland; Treasurer, J. B. Gordon; Secretary, John C. Hoyt; Directors, G. R. Putman, W. C. Allen, W. P. Upton, A. E. Phillips, C. S. Kimball, C. B. Hunt. An illustrated lecture on "Irrigation in the Hawaiian Islands" was given by Mr. F. H. Newell, Director, U. S. Reclamation Service, who spent the past summer in Hawaii.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The next, monthly meeting will be held in the Engineering Societies Building Jan. 12. A paper by Mr. Carl G. Barth of Philadelphia upon "The Transmission of Power by Leather Belting" will be presented, illustrated by lantern slides. This paper is described as a comprehensive summing up of the theory and practice of belting and draws conclusions from the work of Lewis, Bancroft, Bird and others who have made experiments upon the transmission of power by belts. Valuable charts have been prepared by the author for the solution of belting problems. His data have been applied to belting in different plants for many years, giving opportunity to study the problem in great detail.

ROADMASTERS AND MAINTENANCE-OF-WAY ASSOCIATION.—The following subjects have been assigned to committees which will prepare reports for the next annual convention: (1) Organization, methods and cost of relaying rails; (2) switch targets and safety switch devices; (3) comparative values of gravel and stone ballast under heavy traffic; (4) cattleguards; (5) rail joint fastenings, including insulated joints; (6) new track devices and the preservative treatment of ties; (7) tie-plates. There will also be a paper on "Treated Ties" by Mr. J. M. Meade, Engineer of the Eastern Grand Division of the Atchison, Topeka & Santa Fe Ry. The next meeting will be held at Washington, D. C., in November, 1909. The Secretary is Mr. Walter E. Emery, Chief Engineer of the Peoria & Pekin Union Ry., Peoria, Ill.

CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. New York, December 31, 1908.

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CONSTRUCTION NEWS.

PLANS AND SPECIFICATIONS ON FILE.

(denotes that this work is advertised in Engineering News.)*

The following plans (P.) and Specifications (S.) are on file and may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York.

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1- 5	Bridge,	Fairport, N. Y. (S.)	12-17
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1- 9	Galleries, Wash., D. C. (Buildings)		(S.)12-17
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RAILWAYS.

(denotes that this work is advertised in Engineering News.)*

ABBEVILLE & NORTHWESTERN.—This company plans to build a railroad, about 75 miles long, from Abbeville, Ga., via Pineview and Unadilla, to Fort Valley, Ga., 58 miles; and a branch from Emerich to Montezuma, Ga., 17 miles. The authorized capital is $100,000. Headquarters will be at Abbeville, Ga. The incorporators are J. L. Bankston, W. A. Cherry, T. R. Moye, E. M. Carnes, Hal Lawson, W. H. Wilkinson, M. B. Cannon, J. B. Girrardeau, C. F. Chapman and W. L. Harrell, all of Abbeville.

ARIZONA.—The Shannon Copper Co. will build a railroad from Clifton to Metcalf, Ariz., to haul its ore. Estimated cost is $500,000. Company's headquarters are 82 Devonshire St., Boston, Mass. H. B. Clough is Vice-Pres.

CLINTON, DANVILLE & PEORIA.—Incorporated in Illinois to construct a line of road from a point on the Indiana state line east of Georgetown to a connection with the Cleveland, Cincinnati, Chicago & St. Louis Ry. at Fithian, Ill. Capital, $200,000. The incorporators and directors are R. K. Hammond, J. K. Dering, W. S. Bogle, Henry Hafer, J. E. Hitt, Gleen W. Traer and Johnson E. Ford, all of Chicago.

CRAGS & CANON RY.—Incorporated in Colorado to build a standard-gage incline railway from Crags (Rollinsville post-office), on the Denver, Northwestern & Pacific Ry., to Eldorado Springs, thence to Boulder. The final survey from Crags to Eldorado Springs, with a maximum grade of 4%, has been established, it is said, and the line from Eldorado Springs to Boulder will not exceed a mixmum of 1%. The line starts from Crags station, winding around Crags Mountain by way of Crags resort, down the Quartz Creek and South Boulder canyons to Eldorado Springs. Capital stock, $300,000. Incorporators: George F. Keller, Fort Wayne, Ind.; L. B. Bradley, Chicago; G. A. Brink, D. C. Nevin and N. S. Williams, of Denver.

ELBERTA, MOBILE & PENSACOLA.—This company, recently incorporated with $50,000 authorized capital, will build a line about 100 miles long from Bay Minette to Pensacola, Fla. The Baldwin County Colonization Co. is named as the incorporator, the members thereof being Henry C. Bartling, W. J. Levery and C. M. Staiger.

HELENA, PARKIN & NORTHERN.—Contract has been given to D. S. WATROUS, of Parkin, Ark., to build its proposed line. The company, as noted on Dec. 17, recently incorporated to build a line from Whitmore, Ark., St. Francis County, north via Parkin to Marked Tree, Poinsett County, about 25 miles. The incorporators include: G. Casey, D. S. Watrous and E. F. Cooley, of Lansing, Mich., and T. E. Hare, of Vandale, Ark.

HURON & ONTARIO.—It is announced that application is to be made by this company to Parliament for an extension of time to commence work on the lines it has been authorized to build. The charters already granted provide for building lines as follows: From Port Perry, Ontario County, Ont., west via Uxbridge to Kincardine, on Lake Huron, 150 miles; from Priceville, Grey County, Ont., north to Meaford, thence west via Owen Sound to Southampton, then southwest via Port Elgin and Tiverton to Kincardine, 95 miles; from Walkerton, Bruce County, south to Mildmay, thence west via Teeswater to Lucknow, then southwest to Goderich, 55 miles, with a connecting line from Lucknow northwest via Ripley to Kincardine, 20 miles. T. M. Sanders is Engr., in charge of construction and equipment, and H. Middlemist, of Toronto, is Consult. Engr.

KEWEENAW CENTRAL.—Surveys are being made from Mandan, Mich., to Fish Cove, twelve miles. J. C. Shields is Gen. Supt., Phoenix, Mich.

KETTLE VALLEY.—A subsidy contract, of $3,200 a mile, has been entered into with the Canadian Government for the construction of a railway line from Carmi, B. C., to Penticton, about 50 miles. F. Demuth is Supt., Grand Forks, B. C.

LONG ISLAND R. R.—See item under Buildings—Creedmoor, N. Y.

MOUNTAIN, VALLEY & PLAINS.—Chartered in Texas to build approximately 150 miles of line in this state. Principal office will be at Dalhart, Tex. Capital stock, $3,000,000. As noted on Sept 10, this company was organized in New Mexico to build a line from Cimarron, N. Mex., through Amistad and Central City to Nara Visa. The work of grading will begin soon. The company is capitalized at $3,000,000, of which $130,000 has been subscribed. The incorporators are: Jay M. Cogan, Canton, Ohio; Del W. Herrington, Dalhart, Tex.; Charles J. Bushnell, Beecham, N. Y.; C. A. Macy, M. Weimer, Charles Cogan, W. A. Schuler, J. E. Buskirk, Ben O. Boyce, L. D. Chambers and H. S. Wanamaker, all of Amistad; J. S. Holland, Holland, N. Mex. The offices of the company will be at Amistad. Mr. Wanamaker is Gen. Mgr. The railroad will be about 500 miles long.

QUEBEC, MONTREAL & SOUTHERN.—Surveys have been made for an extension to be built, from Ste. Philomene, Que., east to Quebec Bridge, 41 miles; and to Levis, an additional seven miles; also for a branch from Becaucourt to St. Lawrence River, four miles. F. D. Anthony is Ch. Engr., Montreal, Que.

RUSTON, NATCHITOCHES & NORTHEASTERN. Surveys are completed by this company and location accepted from Ruston to Farmersville, La., 26 miles. Construction will be light. Contract will not be let for some time. J. C. Nolan is Pres., Ruston, La.; J. Weston Hall is Ch. Engr.

ST. LOUIS & ILLINOIS BELT.—Contract has been awarded to J. A. WARE CONSTRUCTION CO., 308 Houser Bldg., St. Louis, Mo., for building an extension of this road from the present end of track to Edwardsville, Ill., four miles.

ST. MAURICE VALLEY.—A subsidy contract at $3,200 a mile, has been entered into with the Canadian Government for the construction of this railway line from Three Rivers, Que., northwest to Grand Mere, about 28 miles.

SAVANNAH, AUGUSTA & NORTHERN.—It is stated that surveys have been made from Statesboro, Ga., a point about 35 miles northwest of Savannah, to Chattanooga, Tenn. Track has been laid on the first 25 miles from Statesboro to Garfield. Grading is finished from Garfield to Louisville, about 20 miles, and right-of-way secured from Louisville, to Commerce, in Jackson County, about 100 miles. E. M. Rice is Ch. Engr., Statesboro. Noted on Sept. 17. Company was organized to build a line from Savannah, Ga., northwest to Chattanooga, Tenn., with an easterly line to Augusta, a total of about 425 miles.

SHREVEPORT NORTHEASTERN. — Construction is said to be under way on this railroad which will extend from Shreveport, La., to Homer, 47 miles. Between Homer and Minden, 20 miles, track is completed. T. J. Hardeman, Minden, La., is Ch. Engr.

WHEELING & LAKE ERIE.—We are officially advised that company "has no new construction work in progress, or serious contemplation for the immediate future other than the completion of the low grade cut-off line between Bolivar, Ohio, and Orrville, Ohio, and known as the Sugar Creek & Northern Railroad. This work was started three years ago and because of the financial depression work was suspended. Company has resumed work on this line, and work is now in active progress, as there remains only a small amount of work needed to finish the main line. This work is being done by company's forces and should be completed in the next three or four months. Near the intersection of the cut-off line with the Cleveland-Zanesville Division of the Wheeling & Lake Erie Railroad 1½ miles northwest from Justus, Ohio, a large interchange yard will be built and locomotive shops constructed. It is contemplated to do this work with company's own forces and not to award any of this work by contract." B. A. Worthington is Receiver; H. T. Douglas, Jr., is Ch. Engr., Cleveland, Ohio.

ELECTRIC RAILWAYS.

RUTLAND, VT.—The Rutland Ry., Light & Power Co. may build an extension to Poultney next year. Geo. S. Haley is Gen. Mgr.

MONTPELIER, VT.—The Montpelier & Essex Junction Traction Co. will be incorporated by F. M. Corry, L. E. Taft, W. T. Dewey and E. H. Deavitt, of Montpelier; A. L. Hewitt, of Berlin; D. E. Moody and W. J. Boyce, of Waterbury; E. W. Huntley, Duxbury, Mass.; J. W. McGargan, of Richmond; A. L. Bingham, B. J. Wright and J. E. Kennedy, of Williston, and Guy W. Bailey and Allen Martin, of Essex Junction. Company proposes to build an electric road through Berlin, Middlesex, Moretown, Waterbury, Richmond, Hinesburg, Jericho, Colchester and Underhill. Capital stock will be $50,000.

NORWICH, CONN.—We are officially advised that the Norwich, Colchester & Hartford Traction Co. has completed arrangements for a survey for its proposed line from this city to Hartford, 38 miles in length. Costello Lippitt is Pres., Lucius Brown, Secy. and Henry W. Tibbits, Treas., all of Norwich.

CHESTER, PA.—The Chester, Concordville & West Chester Elec. Ry. Co. proposes to build an electric line 20 miles long to connect these places, we are officially informed. Right-of-way is partly secured. Capital is not yet ready. Survey has not been made. Noted on Nov. 26.

DONORA, PA.—The Donora & Eldora St. Ry. Co. will locate its power station and repair shops at Donora. As noted on Nov. 12, contract for building this line has been awarded to FRANK DONATELLA, Pittsburg. It will run from Donora to Eldora, Monongahela City, Charleroi, Monnessen, Webster and West Newton, Pa. about four miles. Capital stock, authorized and issued, $150,000. Officers: B. M. Hanna, Pittsburg, Pa., Pres.; Wm. M. Galbraith, Frick Bldg., Pittsburg, Vice-Pres.; R. W. Hervey, Monongahela, Pa., Secy. and Treas.; Gisli Gudmundson, Empire Bldg., Pittsburg, Ch. Engr. Noted on Aug. 27 and Feb. 6, 1908.

COLUMBIA, PA.—The Columbia & Manor St. Ry. Co. plans to begin active construction on its line next spring. It will be about 17 miles long and will connect Columbia, Washington Boro and other places in Lancaster County. Henry Wertz, Washington Boro, is Pres.; H. M. H. Alderman, Lancaster, Pa., Vice-Pres.; E. K. Hershey, Lancaster, Pa., Secy. and Treas.; J. B. McDivitt, Safe Harbor, Pa., Ch. Engr. Capital stock, authorized, $225,000.

BIRMINGHAM, ALA.—We are officially advised that the Birmingham & Shades Mountain Electric Ry. Co. will build a 5-mile line. It is practically an extension southward of the South 15th St. line of the Birmingham Ry., Light & Power Co. Contracts will be let soon. Right-of-way is secured and surveys are made. Capital is about one-half subscribed. Organization of company is not yet completed. Ohl & Totten are the Engrs., 103 North 20th St., Birmingham. Noted on Nov. 5.

JACKSON, MISS.—R. V. Powers, W. Q. Cole and R. L. Bradley have applied to the City Council for a franchise, and to the State for a charter for the construction of a belt line to connect the railroads in Jackson.

GARY, IND.—The Gary, Hobart & Valparaiso Traction Co. has started preliminary surveys and expects to begin construction in the spring. Jas. S. Hopkins, Chicago, is Pres.; Frank Y. Keator, Chicago, is Vice-Pres.; Blake A. Mapledoram is Gen. Mgr. and Ch. Engr., Valparaiso, Ind.

The Common Council of Valparaiso has granted the Gary, Hobart & Valparaiso Traction Co. a 50-year franchise to build a line on Main St. The company likewise has a 50-year franchise over the tracks of the Gary & Interurban Ry. in Gary, and a 50-year franchise through the streets of Hobart. Franchises have not yet been granted for the remainder of the route, a distance of 20 miles, extending from College Hill in Valparaiso to the steel works in Gary, Ind. Noted on Nov. 26.

VINCENNES, IND.—The Vincennes & Washington Transit Co. will begin construction next spring on its proposed 19-mile electric interurban railway from Vincennes to Washington, Ind., via Monroe City and Wheatland. Contract for the entire construction of the road awarded to BURNS & CO., Chicago, Ill., who will purchase all material. Officers: J. J. Burns, Chicago, Ill., Pres.; M. A. Peoples, Tampico, Ill., Vice-Pres.; C. S. Nossette, Monroe City, Ind., Secy.; Clyde F. Burns, Chicago, Ill., Treas. and Ch. Engr. Headquarters, 705 Isabella Bldg., Chicago. Noted fully on June 25 and June 18.

ALLEGAN, MICH.—It is announced that the Trans-Michigan St. R. R. Co. has made arrangements for building its proposed line which will connect Allegan and South Haven, Mich., 30 miles. The power station and repair shops will be located in Allegan City. Several small lakes and amusement resorts will be reached by the line. The company expects to operate about 20 cars. Headquarters, Allegan City. Wm. Pyatt, 262 Michigan Ave., Chicago, is Pres.; Martin Fiatow, 1122 North Halsted St., Chicago, Vice-Pres.; Frank B. Kamarke, 122 Perry St., Chicago, Gen. Mgr. and Electrical Engr. Capital stock, authorized, $100,000; issued, $40,000. The company is said to be in the market for rails and ties.

PEORIA, ILL.—A. S. Atwood, Secy. of the Peoria & Galesburg Ry. Co., Peoria, advises us that construction contracts will not be let until June or July, 1909. The line will be about 60 miles long and will extend from Peoria through Trivoli, Elmwood and Yates City to Galesburg, Ill., and from Trivoli to Canton, Ill. D. M. Mayer is Pres. and C. E. Dunn is Ch. Engr., Peoria. Right-of-way is now being obtained. Capital has been secured. Noted (under Railways) on Dec. 3.

MORRIS, ILL.—Ernest Freeman, 356 Dearborn St., Chicago, Ill., Pres. and Mgr. of the United Electric Co., which supplies Morris with light and power, has applied for a franchise to build an electric railway in Morris. A line may be built from Seneca to Joliet, and also a line north and south from Yorkville to Dwight, with branches to the coal field towns.

FOND DU LAC, WIS.—The Wisconsin Rapid Transit Co., we are officially informed, has let contracts for building the proposed line from a connection with the Chicago & Milwaukee Elec. Ry. to Hartford, Fond du Lac, Ripon, Green Lake and Berlin, Wis., 110 miles. Surveys are made. Right-of-way is partly obtained. Noted in detail on Nov. 5. Chas. D. Smith is Pres., and J. N. Gilbert is Ch. Engr., Fond du Lac.

ALBIA, IOWA.—The Albia Interurban Ry. Co. has under consideration the construction of a branch from Albia to Buxton. C. B. Judd is Ch. Engr.

KANSAS CITY, KAN.—F. P. Dickson, Pres. of the Kansas City & Olathe Elec. Ry. Co., Gumbel Bldg., Kansas City, Mo., advises us that construction contracts probably will be let early next spring for the extension which will run from Rosedale (Kansas City), Kan., to Armourdale. It will be about four miles long. Right-of-way and capital are partly obtained. Survey has been run.

LITTLE ROCK, ARK.—The Little Rock & Hot Springs Elec. Ry. Co. has secured necessary capital for construction of its proposed line, it is reported. It will be 51 miles long. Estimated cost is $1,500,000. Louis Garrett is Mgr. Construction, and Chas. J. Kramer is Pres., Little Rock. Bids will be taken in January. Noted on Nov. 19.

The Little Rock Ry. & Elec. Co. will double track section of its line at cost of $75,000. D. A. Hegarty, Gen. Mgr.

MISSOULA, MONT.—The City Council has called a special election for Jan. 5, 1909, when the matter of granting a 50-year street-car franchise to W. A. Clarke, of Butte, Mont., will be voted.

MOUNT PLEASANT, TEX.—M. C. Wolfe, Mgr. of the Red Mineral Springs Development Co., of Mount Pleasant, who is interested in plan to build an interurban railroad between Red Springs, Mount Pleasant and Pittsburg, Tex., twelve miles, advises us that company has not been organized yet, but probably will be organized in January, when arrangements will be made for construction. Noted on Nov. 26.

GAINESVILLE, TEX.—The Gainesville City Council has granted a franchise to E. S. Alnut and C. E. Ball for a street railway four miles long, to be operated with gasoline motor cars.

DEL NORTE, COLO.—The San Louis Valley Interurban Ry. Co. has been incorporated to build an electric railway from Del Norte, running in an easterly direction to Center, also running from Monte Vista to Center, then to the location of the Devil's Gate reservoir and from Center to Saguache. Headquarters, Del Norte. Capital stock, $500,000. Incorporators: John M. Moser, E. L. Fleshman, Adam J. Weiss, W. W. Adams, Leland A. Bernard, George W. McGraw and James S. Warren.

CLAREMORE, OKLA.—The Claremore Street Ry. Co. has been incorporated in Oklahoma to build an electric railway in Rogers County. Capital stock, $300,000. Incorporators: W. J. Perdue, C. F. Godbey, O. C. Wing, H. Jennings and Hiram Stephens. Company is controlled by the Perdue's Sanitarium & Street Railway Co., which has been organized to build a street-car line about four miles long and a sanitarium at Claremore.

NORTH YAKIMA, WASH.—The Yakima Valley Traction Co. proposes to build about 25 miles of new railway next year. D. D. Egan, Seattle, Wash., is Gen. Mgr.

NORTH YAKIMA, WASH.—The Cle Elum-Roslyn Railway & Power Co. has been incorporated for the purpose of building and operating an electric railway from Cle Elum to Roslyn. Capital stock, $100,000. Incorporators: Frank S. Farquhar and W. E. Farquhar. Noted on Dec. 10.

OREGON CITY, ORE.—The Clackamas Southern Ry. Co. has been incorporated to build an electric railway to connect Oregon City with the Molalla Valley, in Clackamas County, with a southern terminus at Scott's Mills on Butte Creek. Right-of-way is secured, it is stated. Incorporators are F. M. Swift, David Loring and A. E. Clark, of Portland.

BOISE, IDAHO.—The Boise Valley Ry. Co. probably will construct two new lines next year, one to extend from Meridian to Nampa and the other from Nampa to Caldwell. W. N. Donaldson is Mgr., Boise.

LIGHT AND POWER PLANTS.

(denotes that this work is advertised in Engineering News.)*

MERIDEN, CONN.—The Meriden Gas Light Co. has petitioned the General Assembly for an amendment to its charter to empower it to extend its mains and pipes within the towns of Southington and Cheshire. Charles A. Learned is Gen. Mgr.

MASSENA, N. Y.—The St. Lawrence River Power Co., Massena, N. Y., has awarded contract to the DAYTON GLOBE IRON WORKS, of Dayton, Ohio, for two water turbine units, each set consisting of six 60-in. turbines, with a total capacity of 12,000 HP. The equipment, together with the electrical generators, will be installed during the coming spring. T. A. Gillespie, 30 Broad St., New York, is Pres.

NEW YORK, N. Y.—The following bids were received by Robert W. Hebberd, Comr. of Public Charities, on Dec. 23, for materials and labor required for the complete conduiting electric wiring, and all other work in connection with the installation of a complete electric lighting and power system for certain of the buildings and grounds under the jurisdiction of the Department of Public Charities, City Hospital District, Blackwell's Island, Boro. of Manhattan: Commercial Construction Co., 114 E 28th St., $4,855; Cowden & DeYoung, 45 East 42d St., $5,488; Louis Weschler, 1133 Broadway, $5,328.

NYACK, N. Y.—Arrangements are being made by the Rockland Light & Power Co. for extensive additions and improvements to its plant, which will include the installation of a 1,000-KW. turbine with surface condenser and cooling tower, switchboard, boilers, etc., and also an addition to the plant at Orangeburg, N. Y. J. S. Avery, of Nyack, is Mgr.

NEW MARKET, N. J.—The Township Committee and Light Commissioners of Piscataway Township are reported to be considering the question of establishing an independent company for the purpose of furnishing electricity for the town. Under the contract, which goes into effect Jan. 1, the Public Service Corporation proposes an increase of $3 per lamp per year and shortening the hours of service. It is proposed to organize a company with a capital stock of $100,000 and erect a plant at New Market Pond. It is estimated that a plan can be equipped for $10,000 and the distributing system erected for $90,000. J. Edward Clark and Edward Radell are interested in the project. The Township at present pays the Public Service Corporation $5,000 per year for the lighting service.

FORD CITY, PA.—An electric light plant is to be established here, it is stated, at an estimated cost of $16,000.

CONNELLSVILLE, PA.—The West Penn. Electric Co. has decided to erect a power plant in Fayette County. This plant will be a duplicate of the one that is now in use at Fayette Station, and will cost about $1,500,000. It will have a rated capacity of about 22,000 HP., which is the capacity of the one in use at present. This present station has two 5,000 HP. steam turbines, three 2,000 HP. turbines and three engines of 2,000 HP. each. The site of the power plant has not been decided on yet, but it is thought that it will be built in the Southern part of Fayette County, near the Monongahela River, as the company has been rapidly extending its lines in that direction. The power-house will be on the power loop of the concern, and will supply power for the West Penn. Railways Co. The company is headed by James S. and H. A. Kuhn, of Pittsburg, Pa. L. H. Conklin, of this city, is Gen. Supt. of the company.

YOUNGSTOWN, PA.—THE WEST PENN ELECTRIC CO., of Connellsville, Pa., has been awarded the contract for furnishing electric light for the streets and public buildings here; arc lights on the former and incandescent lights in the latter. The company will build a line into this city at once, and will furnish light, heat and power for the places of business and residences. L. H. Conklin is Gen. Supt.

ERIE, PA.—The ERIE CITY ENGINE WORKS, of this city, has been awarded the contract for the erection of the new electric light plant at the Erie County Almshouse. The contract price is $6,103, and the contract calls for the installation of two Skinner engines and two Burke Electric Co's. generators. The engines will be of 40 and 56 HP., and of the high speed, automatic, direct-connected type. The generators will be of 25 and 35 KW. capacity respectively. The contract for the switchboard has also been awarded to the BURKE ELECTRIC CO. The electric light plant is to be installed in the present power-house, space having been reserved when the structure was erected two years ago, and is to be completed by Feb. 1.

EMPORIA, VA.—The Greenesville Water-Power Co., W. Samuel Goodwin, Pres., has awarded contract to STAMPER BROS. & RAGLAND and HOLLAND & MYERS, Richmond, Va., for construction of dam across the Meherrin River in connection with construction of proposed water-power electrical plant to transmit electricity for lighting and power. The dam is to be built of granite and cement, 36 ft. high at spillway and 700 ft. long and will cost about $150,000. A minimum of 1,400 HP. is to be developed, while the maximum horsepower will probably triple low-water development. About $75,000 additional will be expended in equipment and in taking over local electric-light and telephone systems, both of which will be rebuilt. C. P. E. Burgwyn, Richmond, Va., is Engr.-in-Charge.

BARBOURSVILLE, W. VA.—The United Utilities Co., it is stated, is planning to construct and operate a combined electric, water and steam-heating plant, and will require the following equipment: One 25 KW 225-volt, direct-current generating unit; one 50-gal.-per-minute turbine pump (vertical preferred) direct connected to vertical motor; two 150 HP. boilers (vertical preferred) to operate at 125 lb; a 3-panel switchboard for 220-volt generators to operate in parallel on six 50-amp light and power circuits. Pipe fittings, valves, heaters, etc., will be required. L. L. Dowthat is Mgr.

LEXINGTON, N. C.—Fred H. Smith, of Lexington, N. C., is interested in a company for the purpose of developing water power and construction of hydro-electric plant on the Potomac River in Jefferson County, W. Va., for which surveys are now being made. It is proposed to develop 1,000 HP. The plant will cost about $300,000.

RIDGEWAY, S. C. The Southern Power Co. of Charlotte, N. C., secured options on 40,000 acres of land on Wateree Creek with a view to future development of the water-power.

EAST POINT, GA.—Bids are asked by the city until Jan. 19 for furnishing and installing the equipment for electric-light plant. $15,000 of bonds have been voted; J. C. McKenzie is Mayor. E. H. Davis, Griffin, Ga., is Engr.

SPARTA, TENN.—Walter G. Kirkpatrick, of Jackson, Miss., has been engaged to make plans and specifications for developing about 200 HP., with dam, turbines and generator, on the Calfkiller River.

FRANKFORT, KY.—The date for receiving bids for furnishing and installing fixtures in the New State Capitol at Frankfort, Ky., has been extended from Jan. 5 to Jan. 19. Plans and specifications may be seen at the offices of Frank M. Andrews & Co., Archs., Cincinnati, Ohio, and Waldorf-Astoria, New York, N. Y.

WELLS, MICH.—The Escanaba Power Co. announces that a meeting of the Board of Supervisors of Delta County, at Escanaba, to consider the petition of the Escanaba Power Co., to said Board of Supervisors, now on file with the clerk of said Board, to construct across the Escanaba River in the Town of Wells, in Delta County, three dams for the purpose of accumulating, storing, manufacturing, conducting, using, selling, furnishing and supplying water and water power. P. L. Utley is Pres. Escanaba Power Co.

FLINT, MICH.—The Flint Land Co., Ltd., of Flint, may construct a power plant on Rifle River in Michigan. The company owns flowage rights on 1,500 acres of land and controls about 14 miles of frontage on the river. The property is located about 40 miles north of Bay City and less than 18 miles from Saginaw Bay. It is claimed that by the construction of two dams 2,000 HP. continuously or 4,800 HP. for 10 hours a day can be developed.

CHICAGO, ILL.—The Chicago Rys. Co. contemplates establishing sub-stations in the South Chicago, Grand Crossing and Roseland districts, it is stated. J. M. Roach, 444 North Clark St., is Pres. and Gen. Mgr.

MONMOUTH, ILL.—It is stated that the Rock Island Southern R. R. Co. will let contracts within 60 days for a power plant on the Edwards River. The company will need two 1,500-KW. turbines and necessary boilers. W. W. McCullough, Monmouth, is Gen. Mgr.

ALBANY, MINN.—Bids are asked by the Village Council until Jan. 11 for furnishing material and erecting a municipal electric lighting system under the supervision of Edmund T. Sykes, Engr., of Minneapolis, Minn. Electricity and acetylene gas will be considered. A plant with sufficient output to supply 600 16-c. p. lamps, or the equivalent, is wanted. Thomas Tomasek is Village Recdr.

TOPEKA, KAN.—The city [illegible] has been instructed to advertise for b[illegible] the construction and equipment of a [illegible] plant for the municipal light plant. A[illegible]propriation of $60,000 has been made for [illegible]construction of a new plant. H. K[illegible]rich, Topeka, is Supt.

CHEYENNE, WYO.—The Ch[illegible]e Light, Fuel & Power Co. is preparin[illegible] construct two gas furnaces at its w[illegible] Cheyenne plant. C. H. Williams, Den[illegible] Colo., is Gen. Mgr.

MACON, MO.—Plans are b[illegible]ade for improvements and additions to [illegible]unicipal electric light plant and wate[illegible] system, the cost of which is estimate[illegible]$18,000. E. S. Bennett is Supt.

BOONEVILLE, ARK.—Th[illegible]ooneville Light & Water Co., incorporate[illegible]s $50,000 capital stock, proposes to constr[illegible]nd operate a water-works system, elect[illegible]t and power plant and telephone exc[illegible] John T. Thayer is Pres.; Joseph Ei[illegible]d, Vice-Pres.; W. Earl Harrell, Secy.

HOOKER, OKLA.—The city n[illegible]ed $20,000 of bonds for construction [illegible] electric light plant and water-works, to b[illegible]completed and in operation by May 1.

PUEBLO, COLO.—The Kansas [illegible]orado R. R. Co. has awarded the contract [illegible] the construction of its railway, including [illegible] the construction of track, bridges, stee[illegible]quipment, power stations, overhead equi[illegible]c. etc., to A. B. HULIT, Central Bio[illegible] Pueblo, Colo. Work has already commenc[illegible] on the railway, which will extend from [illegible]on City to Dodge City, Kan., a distance o[illegible]5 miles. Plans are now being prepared b[illegible]rgeon & Lundy, Railway Exchange Bldg[illegible] Chicago, Ill., for one of the power-hous[illegible] It has been decided to locate one of the [illegible]ower stations at Garden City, Kan.

HOLLY, COLO.—Bids are asked until Jan. 6 by N. F. Vidal, Town Clerk, for furnishing machinery for the water-works system, separate bids being received as follows: For furnishing generator and switchboard; for deep well pump and motor, underwriter pump and boiler feed pumps; for 125-HP. automatic high-speed engine; for steam boilers, stack and heater; for installing above machinery, building foundations and furnishing and installing steam piping, wiring and placing same in operation; for furnishing all material and installing the same complete. Burns & McDonnell are Engrs., 821 Scarritt Bldg., Kansas City, Mo.

WARD, COLO.—J. E. Haggard, Pres. and Gen. Mgr. Mount Audubon Power Co., which is arranging to build a hydro-electric plant at Ward, states that work on the plant will commence soon, though actual construction will not be attempted until spring, on account of the weather. The plant will generate 1,500 HP., and will be located about 1½ miles northeast of Ward. The water will be conducted from the St. Vrain to reservoirs near Duck Lake, from which it will be carried in a 20-in. pipe with a fall of 200 ft. in a distance of about one mile. Mr. Haggard states the plant would be completed early in the fall and would supply power to the various mines of the district. The estimated cost is $75,000.

NAPA, CAL.—The Board of County Commissioners has extended the time for receiving bids for a franchise to construct a commission line for the distribution of electricity to the farming districts from Napa into Lake County from Nov. 11 to Jan. 12. N. W. Collins is County Clk.

REDONDO, CAL.—It is reported that the Pacific Light & Power Co. is arranging for the construction of a duplicate of its power plant adjoining the site of the present one. The increasing demand for power and the contemplated extension of the Huntington lines, will require about double the present capacity of the plant. It is intended to carry the same economic system of construction and machinery in the new building. This will give the plant six turbines operated independent of each other.

AMERICAN FORK, UTAH.—Richard R. Lyman, C. E., Engineering Bldg., University of Utah, Salt Lake City, Utah, writes us that he is making a survey for a power plant for the Utah County Light & Power Co., of American Fork, Utah. The total cost of this plant is to be over $100,000. In addition to the machinery that will be needed in this plant, a steel pipe that is to carry a maximum flow of 15 cu. ft. per second, with a maximum head of 2,100 ft., will be required.

NIAGARA FALLS, ONT.—Preparations are being made by the Ontario Power Co. for the construction of a pipe line from the intake at the Dufferin Islands to its power-house below the bank at the foot of the Horseshoe Falls, a distance of about three-quarters of a mile. The company contemplates increasing the output of the plant by 65,000 HP., the cost of which is estimated at about $800,000. The additional pipe line is made necessary owing to the contract made with the Canadian Hydro-Electric Commission to supply electricity to the Government transmission line. F. V. Greene is Pres. and Gen. Mgr., Buffalo.

BRIDGES.

(denotes that this work is advertised in Engineering News.)*

LE ROY, N. Y.—The New York Central & Hudson River R. R. Co., G. W. Kittredge, Ch. Engr., New York, is preparing plans and specifications for eliminating the Stafford crossing by the construction of a viaduct.

MORRISVILLE, PA.—The County commissioners on Dec. 23 awarded the contract for constructing the new bridge over the canal here at Bridge St. to CARL R. CAMP, of Bethlehem, Pa., at $9,894.

STANDING STONE, PA.—The Bradford County Commissioners have awarded the contract for the construction of the new bridge here to the YORK BRIDGE CO., York, Pa., the lowest bidders of the six companies, at $36,899.

PORTSMOUTH, VA.—The city will erect a new bridge to take the place of the Union bridge which connects Fourth and Court Sts. B... Sykes is City Engr.

ENTERPRISE, W. VA.—The Marion Gas Coal Co., Alexander Counter, Waynesburg, Pa., ... contemplates constructing a bridge across West Fork River at mouth of ... Creek to siding contracted for with B... & Ohio R. R. Co.

GRIFFIN, GA.—The Central of Georgia Ry. Co., C. H. Lawrence, Ch. Engr., Savannah, Ga., contemplates the construction of a viaduct across the tracks on Hill St.

NATCHEZ, MISS.—Bids will be received until Jan. 4 by the County Commissioners, Natchez, for constructing a concrete arch bridge ... Bausley Bayou on Liberty Road.

MEMPHIS, TENN.—The Legislative Council has received four bids for the construction of the iron and concrete bridge over the Southern Ry. tracks on Monroe Ave., as follows: Southern Construction Co., $12,068; Gardner & Howe, $9,485; J. A. Omberg, Jr., $14,... Memphis Bridge Co., $11,998, with an allowance of $585 for the material in the old bridge. J. H. Weatherford is City Engr.

PADUCAH, KY.—The city has accepted the plans and specifications of L. A. Washington, City Engr., for the erection of a ... across Bradshaw Creek and awarded contract, at $4,925, to GEORGE WEIKEL, of Paducah.

DAYTON, OHIO.—Bids will be received until Jan. 16 by T. J. Kauffman, County Audr., Dayton, for constructing the superstructure and substructure of a bridge over the Miami River between the Townships of Harrison and Mad River, substructure to consist of two abutments and two piers, and superstructure to be of steel, reinforced concrete or creodone block. Bidders may submit their own plans with bids.

COLUMBUS, OHIO.—The following bids were opened on Dec. 16 by the Board of Public Service, Henry Maetzel, Ch. Engr., for the superstructure of the Mount St. viaduct, in connection with separation of street and railway grades—(a) price per lb. for 586,000 lbs. of steel, (b) totals: Champion Iron Co., Kenton, (a) 3.06 cts., (b) $17,932; McClintic-Marshall Construction Co., Pittsburg, Pa., (a) 3.17 cts., (b) $18,576; Mt. Vernon Bridge Co., Mt. Vernon, (a) 3.24 cts., (b) $18,986; Cowing Engineering Co., Cleveland, (a) 3.36 cts., (b) $19,689; Capitol Construction Co., Columbus, (a) 3.40 cts., (b) $19,924; George W. Jackson, Inc., Chicago, Ill., (a) 3.40 cts., (b) $19,924; Van Dorn Iron Works Co., Cleveland, (a) 3.49 cts., (b) $20,451; King Bridge Co., Cleveland, (a) 3.55 cts., (b) $20,-800; Penn Bridge Co., Beaver Falls, Pa., (a) 3.59 cts., (b) $21,037.

HAMMOND, IND.—The contracts for a bridge over the Grand Calumet River have been awarded by the Chicago, Indianapolis & Louisville Ry. Co., A. S. Kent, Division Engr. It will have one 108-ft. single-leaf bascule span of the Page type, with a 40-ft. plate girder approach span, and one 108-ft. through-truss span so designed that it can be converted into a bascule span when necessary. The bridge will be wider than an ordinary single-track bridge as it is intended to lay a gantletted track. Both main spans will rest upon a pier in the center of the river. All the piers will be of concrete, resting on hard blue clay at 24 ft. below Chicago city datum. The channel depth established at this point by the U. S. Engineers is 21 ft., and the clear width of channel (between the protection piles) will be 85 ft. The contractors are as follows: Substructure, the GREAT LAKES DREDGE & DOCK CO., of Chicago; superstructure, the AMERICAN BRIDGE CO., of New York; erection of superstructure, the FERRO-CONSTRUCTION CO., of Chicago. W. H. Hughes, of Chicago, is Designing Engr., and R. W. Hunt & Co., of Chicago, are Consulting Engrs. for the railway company.

VINCENNES, IND.—The Daviess County Commissioners have awarded the contract to the VINCENNES BRIDGE CO., Vincennes, for the construction of 20 bridges in the county, at $6,000.

CHICAGO, ILL.—Bids will be received until Jan. 15 for constructing a bridge in Sheridan road and I. M. Canal. C. R. Dart is Bridge Engr. Estimated cost, $25,000.

URBANA, ILL.—Bids are asked until 3 p. m., Jan. 14, by the city for a 48-ft. highway bridge on a concrete substructure. Ira O. Baker, Champaign, Ill., is Engr.

CRESTON, IOWA.—Bids will be received by W. F. Craig, County Audr., Creston, until noon, Jan. 4, for furnishing all material and constructing all bridges ordered by the Board of Supervisors of Union County during the year 1909, according to plans and specifications on file at the auditor's office; also a separate bid for all structural material, iron and steel caps, heads, joists, girders, etc., together with the necessary bolts, rivets and rods to correspond; Oregon fir flooring 3 ins. thick, per 1,000 ft.; red cedar piling per lin. ft., steel piling, a, b, c, per lin. ft., steel and corrugated tubs, 24 to 48 ins. in diameter; cement work per cu. ft. for foundations and bulkheads, and per lin. ft. for culvert, 10 ins. at bottom, 8 ins. top of arch, with and without reinforcement; compounded in accordance with the formula of the Ames Agricultural College.

CROOKSTON, MINN.—The city has awarded the contract to the MINNEAPOLIS BRIDGE & IRON CO., Minneapolis, Minn., for constructing the Sampson's Addition bridge, at $15,000. List of bidders noted on Dec. 17. J. E. Carroll is City Engr.

MANKATO, MINN.—The City Council on Dec. 19 awarded the contract to the HENNEPIN BRIDGE CO., Minneapolis, Minn., for the construction of a second bridge across the Minnesota River at $23,900.

LARKIN, KAN.—Plans are being prepared for the construction of a steel bridge over the Arkansas River, here. Estimated cost, $25,000.

WINFIELD, KAN.—The County Commissioners will soon let contracts for constructing the following bridges: Two steel bridges, 180 ft. long, over Spring Creek, one in Rockford Township and one in Morton Township; one 180-ft. steel bridge in Delano Township over Cowskin Creek.

The old steel from the Douglas Ave. bridge is to be used in the construction of a new bridge across the Arkansas River on Lawrence Ave. The other bridge is to be over Chisholm Creek in Wichita Township. Estimated cost, about $16,000.

BEAVER FALLS, NEB.—Bids will be received until Jan. 13 by Dan K. Morgan, County Clk., Beaver City, for constructing all steel bridges that may be ordered by the county during the year 1909.

GRAND ISLAND, NEB.—Bids are asked until noon, Jan. 2, by G. H. Pohl, County Clk., for the construction and erection of wooden and metal bridges for the county for the ensuing year.

LAUREL, MONT.—Final plans have been completed for the erection of a bridge at Laurel by Yellowstone and Carbon Counties. Estimated cost, between $15,000 and $20,000.

LIVINGSTON, MONT.—Bids will be received until Jan. 4 by the County Clerk for the erection of a wagon bridge over the main Boulder River, a wagon bridge over Four-Mile Creek and the construction of about one mile of road.

ST. LOUIS, MO.—Bids are asked until Jan. 15 by the Board of Public Improvements for the construction of a foot-bridge over River des Peres in Forest Park.

LAWTON, OKLA.—Bids will be received until Jan. 5 by J. M. Haynes, County Clk., for constructing a steel bridge with a 100-ft. steel span, 14-ft. roadway, four 24-ft. steel tubes, three 14-ft., three 12-ft. and six 8-ft. steel piles.

NEWKIRK, OKLA.—The Board County Commissioners has awarded the contract for constructing a steel bridge over the Arkansas River here to the MISSOURI VALLEY BRIDGE CO., of Leavenworth, Kan., at $21,550.

COLFAX, WASH.—The County Commissioners on Dec. 9 let the contract for the construction of eight wagon road bridges in the county to I. J. BAILEY & CO., of Wenatchee, Wash., at $18,751. The bridges are to be entirely of steel and work is to commenced in the spring.

LOS ANGELES, CAL.—The contract for the new reinforced-concrete bridge across the Los Angeles River at North Main St. was awarded on Dec. 15 by the Board of Public Works to CARL LEONARDT, at $81,881.

SANTA ROSA, CAL.—Bids will be received at the office of the County Clerk of Sonoma County until noon, Jan. 7, for the construction of the old Main St. bridge, Santa Rosa, over Santa Rosa Creek at Pearson St. F. L. Wright is Clk.

REEDLEY, CAL.—Three bids were opened on Dec. 11 by the Supervisors for the construction of the pile bridge crossing the Kings River near here. The bids were: Mervy-Elwell Co., of Oakland, Cal., $6,100; T. A. Pettus, of Kerman, $4,500; PACIFIC CONSTRUCTION CO., 16 California St., San Francisco, Cal. $5,980 (awarded contract).

SALINAS, CAL.—Bids will be received by T. P. Joy, Clk. Bd. of Supervisors of the County of Monterey until 10 a. m., Jan. 4, for a combined automatic sluice gate and highway bridge, on Elkhorn Slough near Hudson's Landing, in Pajaro road district, Monterey County.

BUILDINGS.

(denotes that this work is advertised in Engineering News.)*

LYNN, MASS.—The plans of Wheeler & Betton, Archs., 59 Exchange St., Lynn, have been accepted for a 16-room school building for the city. Cost, $85,000.

DEDHAM, MASS.—The Board of Education has had plans prepared by Luther Greenleaf, 101 Tremont St., Boston, for a school to cost $60,000.

ATTLEBORO, MASS.—Fontaine & Kinnicutt, Archs., 45 Commercial St., Woonsocket, R. I., have prepared plans for alterations to parochial school and convent in connection with the Church of St. Joseph, at Attleboro. Rev. N. A. Messier, Pastor. Contract will be let about Feb. 1.

ALBANY, N. Y.—Demers & Campaign, Archs., 203 Ilium Bldg., Troy, N. Y., have completed plans for the County Hospital building and submitted same to the Board of Supervisors. The building is to be 220 ft. in length by 74 ft. in depth, three stories in height, of brick construction with Indiana limestone trimmings. It will cost approximately $30,000, with plumbing, heating and ventilating apparatus.

ALBANY, N. Y.—H. R. Jacobs, Mgr. of Harmanus Bleecker Hall, is having sketches made for a theater, to cost about $200,000.

NEW YORK, N. Y.—Bids are asked by R. C. Hollyday, Ch. of Bureau of Yards and Docks, Washington, D. C., until 11 a. m., Jan. 16, for constructing an extension to the chemical laboratory, Building No. 34, U. S. Navy Yard, Brooklyn. Specifications are on file at the office of Engineering News, New York.

Plans have been filed for a group of four 6-story apartment houses to be built in 144th St., 200 ft. east of Broadway, for the Young Realty Co., Charles H. Wallis, Pres., 144th St. and Broadway. They will have a frontage of 87½ ft. and a depth of 86.11 ft., with facades of brick and ornamental stone, and will cost $400,000. Thain & Thain, 4 East 42d St., are Archs.

Plans have been filed for a 6-story elevator apartment house to be built for the Sheer & Ginsberg Realty & Construction Co., 198 Broadway, on 147th St., east of Broadway. It will be of brick, with limestone trimmings, with a frontage of 100 ft. and a depth of 85 ft., and will contain 30 suites of apartments. It is to cost $125,000. W. B. Levitan, 20 West 31st St., is Arch.

Neville & Bagge, Archs., 217 West 125th St., have filed plans for a 6-story brick and stone apartment, 99.11x115 ft., to cost $225,000. The building will be built at Broadway and 160th St. by the Pine Investing Co., 600 West 146th St.

NEW YORK, N. Y.—The Building Superintendent has issued a permit for tearing down the 2-story stable at 47 East 52d St., owned by W. K. Vanderbilt. It adjoins the site of the 7-story dwelling house to be erected for him from plans by Warren & Wetmore, Archs., 3 East 33d St. Those plans were filed some months ago. The original project is to be modified and a larger building erected, which will utilize the stable site. According to the architects' estimate the dwelling is to cost $150,000.

Max Solomon, 105 Ellery St., Brooklyn, will erect a building at 147 West 22d St., from plans by F. C. Zoble, Arch., 114 East 28th St. He will erect a 9-story store and loft building, 45 x 90 ft., of brick and stone construction, to cost $175,000.

Plans have been filed at the Buildings Department by Buchman & Fox, Archs., 11 East 59th St., for a 12-story brick and stone loft building which Charles Kaye will erect at 22 West 26th St., at a cost of $225,000. The structure will be 50 x 88 ft.

Cleverdon & Putzel, Archs., 41 Union Sq., have filed plans for a 12-story loft building, 90 x 100 ft., to be constructed by Max Cohen, 19 West 18th St., at a cost of $400,000. The site is at 31 West 27th St.

NEW YORK, N. Y.—The following bids were received on Dec. 23 by the Trustees of Bellevue and Allied Hospitals for labor and materials required for furnishing and erecting of the equipment in the Pathological Department, and main dormitory of the New Bellevue Hospital, situated on First Ave. and bounded by 26th and 27th Sts., Boro. of Manhattan, the City of New York: Abramson & Engessor & Co., 1971 First Ave., $78,-927; George W. Cobb, Jr., 148 Nassau St., $120,207; Thomas Cockerill & Son, 147 Columbus Ave., $98,800.

NIAGARA FALLS, N. Y.—Harris Lumberg, lessee of the International Theater, and Augustus G. Porter are having plans prepared for a theater to be erected on Falls St., near First St., on property owned by Mr. Porter. It is proposed to have the building completed ready for opening next fall.

POUGHKEEPSIE, N. Y.—The Amrita Club, William T. Ward, Pres., will build a 3-story brick addition to its club-house. Percival M. Lloyd, 39 Market St., is Arch.

SYRACUSE, N. Y.—It is stated that William Ruben and Gabriel Mitchell will erect an 8 or 10-story office building with a frontage of 43 ft. on Warren St. and 99 ft. on Jefferson St., near the Onondaga Hotel. Plans have been completed.

LE ROY, N.Y.—The Board of Education at a special meeting held Dec. 17 had a conference with Wilson Potter, Arch., 3 Union Sq. West, New York, who will prepare plans for a high school to cost $80,000.

CREEDMORE (L. I.), N. Y.—The Long Island R. R. Co. has made application to the Board of Estimate for the privilege to run a spur from its present track at Queens to the grounds of the Long Island State Hospital at Creedmoor for the purpose of transporting brick, lumber, cement, steel beams and other materials, to be used in building the new Long Island State Hospital, for which the state has appropriated $250,000 for beginning the work, and which will ultimately cost not less than $1,000,000. The site of the proposed group of buildings, work upon which is to be begun in the spring, comprises 200 acres, and all lies within the boundary of the City of New York. Upon the completion of the group, which will consist of 25 or 30 brick structures, the present Flatbush State Hospital, it is expected, will be removed from its location on Clarkson St., Brooklyn, to Creedmoor. The new group of buildings is designed for 2,000 patients, and will provide for all the acute cases now cared for at Flatbush, and for a number of chronic patients. The institution will be under the care of Dr. Dewing, the present superintendent at Flatbush. Among the structures to be built are the following: Administration building, dormitories, group for acute cases, group for chronic cases, nurses' home, staff headquarters, tuberculosis pavilion, laundry, storehouses, barns, stables, boiler-house and other buildings. Franklin B. Ware, Albany, N. Y., is State Arch.

NEW YORK, N. Y.—The Bridge Department, J. W. Stevenson, Comr., has awarded contract for the foundations of the proposed Municipal Building at the Manhattan terminal of the Brooklyn Bridge to the J. H. GRAY CO., Broadway and 23d St. Bids were received on Dec. 3 and the bidders were: (a) price per cu. yd. for excavation, (b) total: P. J. Carlin Construction Co., 16 East 23d St., (a) $34, (b) $786,000; R. E. Henningham, 1 Madison Ave., (a) $40, (b) $854,-000; Arthur McMullen, Park Row Bldg., (a) $10, (b) $865,000; Tide Water Bldg. Co., 25 West 26th St., (a) $22.50, (b) $838,500; Gaffney & Stiers, (a) $10, (b) $824,000; J. H. Gray Co., Broadway and 23d St., (a) $15, (b) $622,000; J. C. Rogers, (a) $40, (b) $673,750; New England Construction Co., Exchange Bldg., Boston, Mass., (a) $30, (b) $871,731; Thomas Cockerill & Son, 147 Columbus Ave., (a) $35, (b) $784,000. McKim, Mead & White, 160 Fifth Ave., are Archs.

BUFFALO, N. Y.—A 3-sty stone and brick residence is to be built at Delaware Ave. and West Ferry St. by Thomas C. Meadows, Pres. Buffalo Fertilizer Co., at a cost of $45,000. McCreary, Wood & Bradney, 607 Mutual Life Bldg., Buffalo, are Archs.

BRIDGETON, N. J.—The Building Committee of the Cumberland County Board of Freeholders on Dec. 24 at the old Court-House in this city and opened bids for the erection of the proposed county buildings. Each bidder presented propositions for the building upon five different plans, which had been prepared by Watson & Huckle, Archs., 1211 Walnut St., Philadelphia. There were 16 bidders, as follows, upon the Indiana stone building that will be recommended by the committee: B. Ketcham & Sons, $102,-177; J. Meyer & Son, $112,893; James E. Doak & Son, $99,194; Horace B. Deal, $100,-567; Mark P. Weiss, $97,619; George A. Glenn & Co., $93,050; Edward Fay & Co., $104,947; Cramp & Co., $101,164; Thompson & Stiles, $107,858; Sax & Abbott, $113,752; J. E. & A. L. Pennock, $104,699; Burd P. Evans, $112,380; Lynch Bros., $93,400; Joseph Steelman, $106,297; H. H. Hankins, Bridgeton, $94,475; Walter Titus, $93,000. The committee will present the bids to the Board at the meeting Jan. 1, when the contract will be awarded.

PHILADELPHIA, PA.—The Kensington Trust Co., George S. Cox, Pres., will have plans prepared, it is stated, for a 1-story bank building, to cost from $30,000 to $40,000.

SCRANTON, PA.—C. R. Weatherbogg, Arch., Ft. Wayne, Ind., is preparing plans for a new $500,000 hotel in Scranton.

PHILADELPHIA, PA.—Joseph C. Bogga will begin work immediately on an operation of 132 2-story dwellings on the block of ground between Pemberton St. and Walton Ave., 58th and 59th Sts, which will cost about $300,000.

John C. Knox, Land Title Bldg., has awarded to HARRY P. HAVENS a contract for the erection of a 4-story apartment house on the north side of Pine St., east of 52d, facing Black Oak Park. It was planned by E. Allen Wilson, and will measure 22 x 74 ft.

Cramp & Co., Commonwealth Bldg., have posted plans for the erection of a 3-story brick and stone 27-division school to be built at 59th and Race Sts. at a cost of $175,000. It will measure 180.4 x 88.7. A similar building will be erected at 23d and Cambria Sts.

Builders have been invited to estimate on plans for a 36-division school to be built at Ninth and Tasker Sts., at a cost of about $250,000; on a 15-division school at Second and Tioga Sts., and an addition to the Kelly School, at 28th St. and Columbia Ave.

CLAIRTON, PA.—Bids are asked by Charles J. Rieger, Arch., Peoples Savings Bank Bldg., 307 Fourth Ave., Pittsburg, Pa., until 4 p. m., Jan. 5, for the erection of a 12-room school building to be erected on lot situated at the corner Summit St. and Shaw Ave., Boro. of Clairton, Pa. Thomas J. Byrne is Secy. School Bd.

PITTSBURG, PA.—Alden & Harlow, Archs., Farmers' Bank Bldg., have prepared plans for a 10-story granite building of the Second National Bank, which will replace the structure on the corner of Liberty Ave. and Ninth St. The first three floors of the building will be occupied by the bank, and the balance of the building will be rented for offices. The main entrance to the bank will be from Liberty Ave., and the office entrance will be from Ninth St. The banking room will open into the Ninth St. vestibule also. The equipment to be installed will include power plant, plunger elevators and freight lift. The present building will be razed about April 1 and work will be started on the new structure at the earliest possible date.

WILKES-BARRE, PA.—I. M. LEACH & CO. have been awarded the contract for the erection of the Y. M. C. A. building on North Franklin St. It will cost about $80,000.

*WILKES-BARRE, PA.—Bids are asked until 2 p. m., Jan. 14, by James M. Norris, County Controller, for furnishing floor coverings, draperies and shades for the Luzerne County court-house. McCormack & French, Wilkes-Barre, are Archs.

CORNWELLS (Maud post-office), PA.—Cope & Stewardson, Archs., 320 Walnut St., Philadelphia, have let general contract to STACEY, REEVES & SONS, of Philadelphia, for a 3-story recreation hall and dormitory at Cornwells, for the Sisters of the Convent of the Blessed Sacrament. Cost, $70,000.

BALTIMORE, MD.—The Zell Motor Car Co., 1010 Morton St., which has had plans prepared by Edward H. Glidden, Glenn Bldg., Baltimore, for garage on Mt. Royal Ave., will erect a 3-story structure, of concrete, brick and steel. Cost, $50,000.

The Wizard Amusement Co., 328 North Eutaw St., will erect a moving-picture theater at 30, 32 and 34 West Lexington St. The lots measure 42 x 112 ft. The building will be fireproof; exterior of ornamental metals. Cost, about $75,000.

E. D. Preston, Building Inspector, City Hall, has approved of working plans and specifications for additions to the municipal jail, and construction will proceed. A wing will be built on either end of present building, in appearance to be three stories high, but interior will contain five tiers providing 264 cells. The addition will be of fireproof construction, exterior of local stone. The cells are to be of concrete with steel reinforcement. DAVID PEOPLES, 213 North Calvert St., Baltimore, has contract for erection, at $148,987. Theodore W. Pietsch, American Bldg., Baltimore, is Arch.

Leasehold interest in 29 lots has been sold by the Commonwealth Bank of Baltimore to Vincent M. Kearns. The lots, which adjoin, are on the east side of Braddish Ave., near North Ave. Each is 14 ft. 6 ins. x 67 ft. Mr. Kearns will develop the property with 3-story brick dwellings with marble trimmings. Work on the dwellings will begin at once. The cost will be about $50,000.

BALTIMORE, MD.—Arrangements are being made for erection of a 14-story terra cotta brick hotel to be built on Baltimore St., near Charles St. It will contain about 350 rooms. Jerome H. Joyce, Hotel Joyce, West Camden St., is reported interested.

HAGERSTOWN, MD.—The Y. M. C. A. contemplates erection of a $50,000 association building. Joseph C. Byron is Chn. Bldg. Com.

BALTIMORE, MD.—The Directors of the Eutaw Savings Bank have authorized improvements and additions to the present bank building at Eutaw and Fayette Sts. The entire structure will be remodeled. Property fronting 65 ft. on Fayette St., immediately in the rear of the bank, has been bought and on this the addition will be erected. When completed this will give the bank space room of 65 x 135 ft. In ad-

dition, provision will be made in the plans for a 16-ft. alley both on the south and on the west. William M. Hayden is Pres.

WASHINGTON, D. C.—Plans have been prepared for Harry Wardman, 1333 G St., N. W., Washington, for A. H. Beers, 1333 G St., N. W., for four 3-story brick dwellings at 2112-2118 Bancroft Pl., N. W. Cost, $60,000.

Bids are asked until noon, Jan. 2, by the District Commissioners for constructing a 12-room school building, No. 158, located on Hamilton Road, Square No. 5726, Garfield, D. C.

The U. S. Storage Co., Edward A. Macumber, Pres., 418-422 Tenth St., N. W., will expend about $120,000 in erection of a warehouse at 418 and 420 Tenth St., N. W. The structure is to be 52 × 100 ft.; fireproof, eight stories high, with facade of brownstone, iron and brick; columns, beams and floors of reinforced concrete; steam heat, etc. B. Stanley Simmons, 931 F St., N. W., is Arch.

ROANOKE, VA.—John Kevan Peebles, Arch., Law Bldg., Norfolk, has plans for a 7-story bank and office building for the First National Bank, J. T. Meadows, Vice-Pres., Roanoke. Cost, $150,000.

ATLANTA, GA.—The Capital City Club, W. S. Elkin, Pres., has appointed a committee to consider plans for erection of a $150,000 club-house.

SAVANNAH, GA.—Wallin & Young, Savannah, Archs. for the proposed Y. M. C. A. building, are asking bids on elevator, fire-escapes, ornamental iron work and other materials, etc. Building is 60 × 180 ft.; four stories and basement; brick and limestone exterior (erected). Cost of structure, $140,000.

AMERICUS, GA.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., received bids on Dec. 28 as follows for the construction of a post-office building at Americus, Ga.: John H. Lowe, Atlanta, Ga., $59,875; Wilmarth Bldg. Co., New York, $54,845; Algernon Blair, Montgomery, Ala., $58,800; Miles & Bradt Co., Atlanta, Ga., $53,000; King Lumber Co., Charlottesville, Va., $52,900; Gude & Co., Atlanta, Ga., $54,150; George Becking, Chattanooga, Tenn., $51,257; Robert E. Pharrow, Atlanta, Ga., $55,900. Jan. 1, 1910.

LAKE CHARLES, LA.—Bids were received as follows on Dec. 28 at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office at Lake Charles, La.: Dieter & Wenzel, Wichita, Kan., $143,120; King Lumber Co., Charlottesville, Va., $114,900; Tom Lovell & Son, Denton, Tex., $124,707; Gude & Co., Atlanta, Ga., $135,600.

NEW ORLEANS, LA.—H. T. Cottam & Co., 506 Tchoupitoulas St., will award contract about Feb. 25 for erection of a storage warehouse to occupy a city square. It will be a reinforced concrete structure and will cost about $180,000. Crosley & Henkel, New Orleans, are Archs.

NASHVILLE, TENN.—The Hermitage Hotel Co., E. A. Lindsey, Secy., Stahlman Bldg., has awarded contract to the SNEAD ARCHITECTURAL IRON WORKS, of Louisville, Ky., and to the GOULD CONSTRUCTION CO., of Nashville, for steel work on Hermitage Hotel. The former company will furnish material and latter will undertake construction work. The building is to be completed by May 15. This structure will be ten stories, fireproof; will contain 200 rooms. Estimated cost, $250,000. Carpenter & Blair, 475 Fifth Ave., New York, N. Y., are Archs.

NASHVILLE, TENN.—Plans have been prepared by Mowbray & Uffinger, Archs., 92 Liberty St., New York, for a 5-st. bank and office building for the Union Bank & Trust Co., Nashville. Estimated cost, $150,000.

WAPAKONETA, OHIO.—It is stated that Marriott & Allen, Archs., Columbus, have completed plans for a 2-story county infirmary for the Board of Commissioners of Auglaize County, Wapakoneta. The building will cost $50,000.

LISBON, OHIO.—Bids are asked until Jan. 4 by C. H. Coburn, County Audr., for remodeling and repairing the Insane Building at the County infirmary.

FORT WAYNE, IND.—Trustees of the English Lutheran Church will receive bids as soon as plans are completed for the erection of a $350,000 church; also for a pipe organ.

INDIANAPOLIS, IND.—Plans for the City Hall building will be completed and ready to submit to the Board of Public Works some time after Jan. 15, and bids will be received some time in February, according to Rubush & Hunter, Archs., who have charge of the work. George M. Brill, 204 Dearborn St., Chicago, is Superv. Engr.

INDIANAPOLIS, IND.—Plans are being made by the Great Council of Red Men in this city for the construction of a $300,000 temple on corner of Delaware and Vermont Sts.

EVANSVILLE, IND.—Capt. Lee Howell has ordered plans on which bids will be asked for the construction of a business block on Broadway.

PENNVILLE, IND.—The People's State Bank has ordered plans for the construction of a brick building on the site of the building recently destroyed by fire.

The Home Union Store Co. will ask for bids for the erection of a business block as soon as insurance is adjusted.

ALEXANDRIA, MICH.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., received bids as follows on Dec. 23 for the construction of a post-office building at Alexandria, Minn.: Earle & Aiton, Alexandria, Minn., $41,258; J. W. Miller, St. Paul, Minn., $43,371; Steward & Hager Co., Janesville, Wis., $49,500; Northern Construction Co., Milwaukee, Wis., $46,000; P. M. Hennessey Construction Co., St. Paul, Minn., $45,908; John Lauritzen, Fergus Falls, Minn., $43,637; General Construction Co., Milwaukee, Wis., $44,330. Time, Dec. 15, 1909.

ALTON, ILL.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., received as follows on Dec. 29, bids for the construction of a post-office building at Alton, Ill.: Hiram Lloyd Building & Construction Co., St. Louis, Mo., $64,957; Giacomo Maffiola, Rockford, Ill., $66,270; V. Jobst, Peoria, Ill., $63,496; Charles W. Gladdele, Chicago, $63,275; Globe Construction Co., St. Louis, $66,088; J. E. Simmons, Chicago, $74,546; C. L. Gray Construction Co., St. Louis, $63,356; M. Yeager & Son, Danville, Ill., $68,460; Paschen Bros., Chicago, $66,851; Henry Shenk Co., Erie, Pa., $66,678; J. J. Wuellner & Son, Alton, Ill., $63,459; Barnes Bros., Hamilton, Ohio, $65,-00; English Bros., Champaign, Ill., $68,730; F. M. Roode & Co., Tipton, Ind., $69,400; Northern Construction Co., Milwaukee, Wis., $64,470; North Western Construction Co., Reno, Nev., $68,749.

CHICAGO, ILL.—Bids are asked by the West Chicago Park Commissioners until 4 p. m., Jan. 12, for the construction of the Field House, including gymnasium, shower baths, public lavatories, lunch room, library and reading rooms, assembly hall, club rooms, etc., together with swimming pool, dressing rooms and accessories in Small Park No. 2, located at West 14th Pl., South Jefferson, Union and Barber Sts., Chicago. George A. Mugler is Secy.; W. Carlys Zimmerman, Steinway Hall, Chicago, is Arch.

DECATUR, ILL.—Bids will be received about Jan. 15 by Charles J. Aschauer, Arch., Powers Bldg., for a 3-story stone bank, office and club room building, 100 × 130 ft., to be erected at Water and Main Sts., for the Citizens' Safe Deposit Co., George S. Conrad, Cashier, 162 Merchant St.

GREEN BAY, WIS.—We are officially advised that the Board of Education will erect a 3-story school, to be known as the West Side High School, and to cost $125,000. J. C. Llewellyn, First National Bank Bldg., Chicago, Ill., is Arch.

MADISON, WIS.—The Modern Steel Structural Co., Waukesha, Wis., has been awarded the contract, at $79,009, for furnishing steel for the south wing and part of the central portion of the new State Capitol, at Madison.

KENOSHA, WIS.—T. Gaastra, Arch., 305 Main St., is preparing plans for a 2-story school building, 75x192 ft., for the Board of Education, John E. Williams, Chn. Bldg. Com.

ST. PAUL, MINN.—The State Historical Society, W. Upham, Secy., City, plan to construct a library building here. It will be three stories high and of fireproof construction. Cost, $150,000.

The Knights of Columbus, W. M. Stephenson, Grand Khight, city, propose to construct a $100,000 3-story pressed brick and cut stone club house at Fifth St. and Smith Ave. It will have an auditorium, gymnasium and swimming pool.

ST. LOUIS, MO.—According to the St. Louis "Globe-Democrat," Walter J. Holbrook, Pres. of the Holbrook-Blackwelder Real Estate Trust Co., has announced that he had completed plans for the erection in St. Louis of a department store building. The store is to be located on Olive St., and will represent an outlay of over $2,000,000 for the building, exclusive of the ground.

ST. LOUIS, MO.—Milligan & Wray, Archs., 721 Olive St., have prepared plans for a 3-story and basement mantiacal building for the Board of Public Improvements. A. J. O'Reilly, Pres. Cost, $65,000.

DALLAS, TEX.—Plans have been prepared for erection of addition to St. George Hotel and for remodeling the older portion of the present building. The new structure will have four stories and basement, with foundation sufficiently strong to permit erection of two additional stories. Estimated cost, $50,000.

TULIA, TEX.—It is reported that the Commissioners Court of Swisher County has let entire contract to MARTIN, HOLDERNESS & OATS, Stamford, Tex., at $55,694, for the erection of a 3-story and basement brick and stone court-house. W. B. Hale is County Judge; Withers & Elliott, Stamford, are Archs.

*SAN ANTONIO, TEX.—Bids are asked by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p. m., Feb. 4, for the construction (complete) of the extension to the U. S. post-office and court-house at San Antonio.

STILLWATER, OKLA.—It is stated that the Oklahoma Agricultural and Mechanical College will expend $25,000 for construction of a 3-story boys' dormitory from plans by W. A. Atherton, Stillwater. The contract to be awarded about Jan. 8. The structure will be 37 × 132 ft., of fireproof and mill construction. Mr. Atherton is preparing plans for a $60,000 woman's building for same college, on which bids will be received about March 1.

SEATTLE, WASH.—James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of the Government buildings at the Alaska-Yukon-Pacific Exposition to be held in Seattle in 1909, to STREHLOW, FREESE & PETERSON, of Seattle, Wash., at $220,000. Time, May 1, 1909.

SPOKANE, WASH.—We are officially advised that the Spokane Trust Co. has leased from the Odd Fellows property at the corner of Main Ave. and Waverly St. for a term of 25 years, upon which they will erect an office building to cost about $150,000. Plans are being prepared.

At a recent meeting of the Board of Health it was decided to let the contract, through the Board of Public Works, to JOHN T. HUETTER for building the west wing of the new isolation hospital. The price named is $24,361, and includes everything connected with construction of the wing, wiring, plumbing, heating, etc. The building, when completed, will cost $51,500.

FORT STEVENS, ORE.—Bids are asked by the Constructing Quartermaster until 2 p. m., Jan. 13, for the construction, plumbing, heating and electric wiring and fixtures of one gymnasium and bowling alley and four double sets of N. C. O. quarters and wiring and fixtures of one double set of firemen's quarters at Fort Stevens.

PORTLAND, ORE.—C. W. Fulton, U. S. Senator, has introduced at Washington a bill appropriating $2,500,000 for a public building in Portland; $500,000 for a public building in Astoria, and $100,000 for a public building in Oregon City. The appropriation for $2,500,000 is for purchasing a site and erecting thereon a post-office building in this city. It is estimated that the site can be bought for about $500,000 and the remainder of the appropriation to be used in the construction of a building.

Announcement has been made by David C. Lewis, Arch., that the Lewis Estate will begin the construction of a 10-story reinforced-concrete office building immediately on the corner of Fourth and Oak Sts. The building will have a frontage of 60 ft. on Fourth St. and 100 ft. on Oak St. The building, complete, will cost about $200,000 and will require about twelve months to erect.

SACRAMENTO, CAL.—The contract Committee of the Board of Supervisors has recommended that the Sewart Jail Co. be awarded the contract for the steel cell work in the new county jail building. The contract was let for three tiers. The Stewart Co.'s bid was $31,890 for two tiers, and $41,340 for three tiers. The other bid considered by the board was that of the Pauly Jail Co. of $62,123 for two tiers and $81,313 for three.

LOS ANGELES, CAL.—At an estimated expense of $160,000, a new tuberculosis pavilion, a new maternity ward and an administration building will be added to the county hospital's equipment the coming year. Plans for the new buildings are being prepared and have been submitted to the Supervisors. Dr. D. C. Barber is Supt.

FORT ROSECRANS (San Diego post-office), CAL.—Bids are asked until Jan. 12 by Lieut. Earl McFarland, Constr. Q. M., for construction, plumbing, electric wiring and fixtures, two double sets of N. C. O. quarters at Fort Rosecrans.

SAN FRANCISCO, CAL.—A permit has been granted to the Estate of Claus Spreckels for construction of a 2-story and basement building on the north side of Market St., 226 ft. west of Eddy St., designed for stores and offices. The estimated cost of the building is $70,000.

A building having six stories and a basement is to be erected at the corner of Second and Howard Sts. by Knickerbocker, Barker & Bostwick. It will be of brick, with the first floor laid out for store purposes, and the upper floors for wholesale tenants. The area of the building site is 80 × 80 ft. The owners have secured a loan of $95,000 on their property at the corner of Second and Natoma Sts., covering a lot 57 × 75 ft. The money obtained on this mortgage will be used to pay off a smaller loan now on the property and the balance will be used to construct the new building.

An apartment building is to be erected by A. W. Wilson at the corner of Clay and Gough Sts. The area of the building is 80 × 102 ft. Work on the building was begun before the fire, and the foundation walls were finished. The building will be of brick, with cream-colored pressed brick and terra cotta exterior. Each of the five floors will be arranged for two suites of apartments, of eleven rooms each, with three baths, butler's pantry, spacious rooms and reception halls. The finish will be in pine and oak. Vacuum cleaners, automatic elevators, a refrigerator for every panty, steam heat and other modern features will be installed. C. A. Meussdorffer, Humboldt Bank Bldg., is Arch.

SAN JOSE, CAL.—Bids are asked until 3 p. m., Jan. 19, by the Board of Trustees of the San Jose State Normal School, at the office of M. E. Bailey, Secy., on the Normal Grounds, San Jose, Cal., for construction of Normal school buildings. Bids will be received as per plans and specifications in the several following ways: First, complete Normal building, excluding power-house and plant; second, complete Normal building, except auditorium part; third, complete Normal building, except auditorium part, but including power-house and plant complete; fourth, power-house and plant complete. Sellon & Hemmings, 251 Kearny St., San Francisco, Cal., are Archs.

FORT BAYARD, N. MEX.—Capt. S. P. Vestal, Q. M. at Fort Bayard, is about to call for bids for the construction of buildings, the combined cost of which will aggregate about $250,000. The last Congress appropriated $214,000 for these improvements, and the money being now available, work will start at once. It is expected that it will take at least a year to complete the improvements, which contemplate the tearing down of the present officers' row and substituting therefor six double sets of officers' quarters, each two stories ni height, one single set and quarters for the nurses of the Government hospital, also a storehouse for the medical department. There will be 20 rooms in each double set of officers' quarters, which will be f brick, two stories in height, and will have a 2-story front veranda for sleeping purposes.

MONTREAL, QUE.—It is reported that J. A. Jacobs will erect a number of stores on the property at the corner of St. Catharines and St. Alexander Sts, which he recently purchased for $150,000.

WATER SUPPLY—IRRIGATION.

*PROVIDENCE, R. I.—Bids are asked until 11 a. m., Jan. 8, by the Department of Public Works for furnishing the following sizes of c.-i. water pipes: 618 tons of 2,000 lbs. ,16 ins. in diameter; 309 tons of 2,000 lbs., 12 ins.; 60 tons of 2,000 lbs., 8 ins.; 346 tons of 2,000 lbs., 6 ins.; 10 tons of 2,000 lbs., 4 ins. The delivery to commence on or before March 15, 1909, and to continue as rapidly as required and to be fully completed on or before June 1, 1909. Walter F. Slade is Comr.

EARLVILLE, N. Y.—The W... Board of this village have voted to inst... system of meters.

NIAGARA FALLS, N. Y.—T... ity Engineer is preparing plans for ... nstruction of an intake pipe line, 1,500 ... into the river, and for a filtration plant ... 000,000 gallons daily capacity.

PERTH AMBOY, N. J.—HA... AN & DEDRICKSEN have been award... ontracts by the Water Board for laying ... ft. of 6-in. water pipe on Hall Ave., ... Ave., and Sheridan St. Thomas J. Cl... Pres.

MUNHALL, PA.—Bids are aske... H. I. Maclay, Secy. Boro. Council, un... P. m., Jan .4, for laying about 2,530 ... 6-in. water line in certain streets; a... 60 ft. of 8-in. water line in the Eighth ... extension, and for furnishing and co... ng 32 fire plugs.

PHILADELPHIA, PA.—Revised ... for the filter beds and buildings at ... Lane have been completed, and bids will ... asked early in the new year. Estim... cost, about $2,000,000. George R. Stea... Dir. Pub. Wks.

WARREN, PA.—W. R. LAVERY ... been awarded the contract for construct... a filtration plant for the American Wa... Works & Guarantee Co., 345 Fourth Av... Pittsburg.

WASHINGTON, D. C.—Bids were opened on Dec. 21 by the Commissioners, District of Columbia, for equipping an auxiliary water system and fire protection for the Home for the Aged and Infirm, subdivisions of Bellevue and Blue Plains. The contract has been awarded to P. H. & I. CONLON, of Newark, N. J., at $6,388.

PRINCETON, W. VA.—The Princeton Water-works Co. contemplates the construction of water-works. M. J. Cook, Hinton, W. Va., is interested.

EAST POINT, GA.—Bids are asked by the city until Jan. 19 for furnishing equipment for the construction of water-works. E. H. Davis, Griffin, Ga., is Engr.

*DAYTONA, FLA.—Bids will be received by the Board of Public Works, City Hall, until 3 p. m., Jan. 25, for furnishing materials and constructing a system of water-works here. C. M. Rogers is Engr. Plans and specifications are on file at the office of Engineering News, New York.

PALMETTO, FLA.—Bids will be received until Jan. 5 for a 100-ft. tower and 50,000-gallon tank, riser pipe, foundation, etc., complete. E. F. Wilson is Mayor.

CLEARWATER, FLA.—The city has voted $25,000 of bonds for the construction of water-works, the pumps to have a capacity of 400 gallons per min.

MONTGOMERY, ALA.—The citizens voted on Dec. 14 to issue $25,000 of bonds for water-works extension. Wm. Teague is Mayor.

SCRANTON, MISS.—The city will lay about two miles of c.-i. pipe, with hydrants and valves, and will construct a 75,000-gallon steel tank and tower, and install hydraulic ram to pump from flowing artesian well. Walter G. Kirkpatrick, Jackson, Miss., is Engr.

MERIDIAN, MISS.—Bids were opened on Dec. 8 by the City Water-Works Commission as follows: Reinforced concrete reservoir: Cook Construction Co., Des Moines, Iowa, $17,500; Piedmont Construction Co., Atlanta, Ga., $11,935; C. W. J. Neville, New Orleans, La., $12,984; Paul N. Kershner, Dayton, Ohio, $12,000; Dubush-Dibbs Construction Co., Meridian, $12,000; Missouri Valley Bridge & Iron Co., Dallas, Tex., $14,-490; J. A. Ormberg, Memphis, Tenn., $15,-900; H. M. Severance, Shreveport, La., $18,-522; Gallagher & Erdman, Columbia City, Ind., $12,362; Southern Improvement Co., Memphis, Tenn., $16,970; Charles R. Lewis, Utica, N. Y., $12,822; Constantin, Rees & Guerin, New Orleans, La., $14,950; West Construction Co., Chattanooga, Tenn., $13,-723; Foulks-Forbes Co., Terre Haute, Ind., $12,650. For a 5,000,000-gallon horizontal cross compound and fly-wheel pumping engine: Nordberg Mfg. Co., Milwaukee, Wis., two sizes, $18,800 and $22,350; Platt Iron Works, Dayton, Ohio, $15,500; Hardy-Tynes Mfg. Co., Birmingham, Ala., three sizes, $16,650, $16,095 and $15,400; Fred. M. Prescott Co., Milwaukee, Wis., two sizes, $11,210 and $16,377; Wilson-Snyder Mfg. Co., Pittsburg, Pa., $17,600; Hoovens-Owens-Rensalaer Co., Hamilton, Ohio, four sizes, $... $19,750, $20,750 and $20,450; Allis-Chalmers Co., Milwaukee, Wis., three sizes, $16,790, $15,700, $17,144 and $16,050; Jeansville Iron Works, Hazleton, Pa., two sizes, $18,880 and $21,956; A. M. Lockett & Co., New Orleans, La., $12,330; Wisconsin Engine Co., Milwaukee, Wis., two sizes, $18,300 and $17,-300; Canton-Hughes Pumping Co., Canton, Ohio, two sizes, $14,159 and $13,650. W. G. Wetmore is City Engr.

SPARTA, WIS.—The Water Commission is now investigating the question of constructing a reservoir, of about 300,000 gallons capacity, 40 × 25 or 30 ft., of concrete or steel. Nothing definite will be done until spring. Howard Teasdale is Pres.

DENISON, IOWA.—Bids, including plans and specifications, will be received until Feb. 1 by M. D. Wright, Chn. Water Commission, for boring an artesian well, 12 ins. in diameter, at the surface and not less than 4 ins. at the bottom; depth, 2,000 ft. if necessary.

WINTERSET, IOWA.—The City Council on Dec. 14 awarded the contract to the DES MOINES BRIDGE & IRON WORKS, Des Moines, Iowa, for the construction of the water-works system here at $54,490. Other bidders were: G. Joeger, Rich Hill, Mo., $57,300; Turner Roland Co., Des Moines, $56,900; T. C. Brooks & Son, Jackson, Mich., $59,980; Cook Construction Co., Des Moines, $58,490; W. D. Lovell, Minneapolis, Minn., $57,840; Katz-Craig Construction Co., Omaha, $58,888.

MINNEAPOLIS, MINN.—Bids will be received by the city until 7.30 p. m., Jan. ... for the following material for water-works

construction during season of 1909: C.-I. pipe, 1,... tons; special castings, 125 tons; hydrants, ... D. S.; valves, 100 6-in., 15 8-in., ... in., 2 24-in. Andrew Rinker is City Engr.

SPOONER, MINN.—George E. Ericson, of Spooner, has prepared plans for the construction of water-works. Estimated cost, $15,000. C. ... Dodds is Village Clk.

ST. PAUL, MINN.—The DIMMICK PIPE CO., Birmingham, Ala., was awarded the contract on Dec. 14 by the Water Board for the ... pipe for the city the coming year at ... $60,000. The contract calls for ... and 15 miles of pipe.

The NORTH PARK MACHINERY CO., St. Paul, received the contract for the hydrants for ... year, at $5,000. L. W. Rundlett is City Engr.

EVELETH, MINN.—The lowest bid opened on ... by the City Council for a steel water tank of 300,000 gallons capacity was submitted by the Chicago Bridge & Iron Co., ... and Throop Sts., Chicago, Ill., at $12,-850.

The lowest bid for the pipe line from the city pumping station at St. Mary's Lake to the site of the water tank was that of P. G. Pastoret, of Duluth, at $12,834.

EAST GRAND FORKS, MINN.—Bids will be received by the City Council until Jan. 5 for furnishing and installing a pumping plant for the municipal water-works. C. P. Zimmerman is City Clk.

WICHITA, KAN.—Bids will be received until Jan. 1 by R. N. Dorr, City Clk., for constructing water-works.

*WELLINGTON, KAN.—Bids are asked until Jan. 18 by the city for the erection of a water tank 140 ft. in height, and of a capacity of 150,000 gallons.

GRAND FORKS, N. DAK.—The City Council on Dec. 15 awarded the contract to the ROBERTS FILTER MFG. CO., Philadelphia, for a mechanical filter plant, at $3,017. The contract for the pump house was awarded to the NORTHERN CONSTRUCTION & ENGINEERING CO., at $9,175. J. J. Smith is City Engr.

HAMILTON, MONT.—The Bitter Root Valley Irrigation Co. will dig an 85-mile ditch here to water 65,000 acres of land.

MISSOULA, MONT.—CLINTON & DESMARAIS have secured the contract for rebuilding the dam of the Grass Valley Ditch Co.

BOONVILLE, ARK.—See item under Light and Power Plants.

CLINTON, OKLA.—Bids are asked by the town until 8 p. m., Jan. 5, for furnishing all tools, labor and material for about 40 blocks extension to the distributing system of the water-works. S. J. Storm is Town Clk.

HOOKER, OKLA.—See item under Light and Power Plants.

HOLLY, COLO.—Bids will be received until Jan. 6 by N. F. Vidal, Town Clk. for furnishing machinery for the water-works, separate bids to be submitted as follows: Generator and switchboard.. deep well pump and motor; underwriter pump and boiler feed pumps; 125-HP. automatic high-speed engine; steam boilers, stack and heater, all to be f. o. b. cars, Holly; for erecting above material and constructing foundations and furnishing and installing steam piping, wiring and placing same in operation; also bids to include all the work and machinery. Burns & McDonnell are Engrs., Scarritt Bldg., Kansas City, Mo.

TACOMA, WASH.—The City Council on Dec. 16 voted $250,000 for the improvement and extension of the water system. More wells will be dug at South Tacoma and a pipe line will be built from Maplewood Springs. A. J. Whitney is Engr. W.-Wks.

SPOKANE, WASH.—The Board of Public Works on Dec. 16 awarded the contract for a 4-mile force main to be laid from the pumping station to Division St., to JAMES C. BROAD, 2115 Dean Ave., Spokane, at $103,708. J. C. Ralston is City Engr.

*GRIDLEY, CAL.—The Board of City Trustees on Dec. 14 received five bids for the construction of the steel tank and tower for the city water-works system. The bids were as follows. Minneapolis Steel & Machinery Co., San Francisco, $4,350; Chicago Bridge & Iron Works, Chicago, $3,480; DES MOINES BRIDGE & IRON WORKS, Des Moines, Iowa, $3,830 (awarded contract); Hugh McGuire, Marysville, Cal., $4,307; Edward Cahill, San Francisco, $4,900. Mr. Cahill made a bid of $4,650 for a concrete tank and tower.

SAN FRANCISCO, CAL.—Following the dissolution of an injunction on Dec. 18 by Judge Seawell, secured by the D'Olier Engineering Co., of Philadelphia, Pa., restraining the Board of Public Works from entering into a contract with the Byron Jackson Iron Works to furnish the pumps for the auxiliary water system and the new fireboats, final action upon the disputed contract was taken, when the Board awarded the contract to the BYRON JACKSON IRON WORKS, 61 Fremont St., San Francisco, at $120,000. Noted last week.

SALT LAKE CITY, UTAH.—Bids will be received until Jan. 8 by the Board Public Works for constructing a pipe line in the 19th Ward Irrigation district. Louis C. Kelsey is City Engr.

POCATELLO, IDAHO.—The BANNOCK ENGINEERING CO., of Pocatello, has been awarded the contract for the construction of 17 miles of canal for the Portneuf-Marsh Valley Irrigation Co., to deliver water to the Carey act tract about 40 miles east of here.

BOISE, IDAHO.—The Owyhee Land & Irrigation Co. has been incorporated and will develop a Carey act project of 42,000 acres on the south side of the Snake River. The waters of Castle, Meadows and Spring Creek will be utilized, together with storm waters of Boulder Creek. Large reservoirs will be build on Castle Creek. The work of construction will begin at once. M. D. Polk is Pres.; C. S. Polk is Secy. and Treas.

SEWERAGE.

(denotes that this work is advertised in Engineering News.)*

LAKE PLEASANT, MASS.—The construction of a sewerage system for the protection of the water supply of the Turner Falls Fire District is being considered.

MONSON, MASS.—Surveys are being made for the construction of a sewerage system here. C. T. Peck is Town Clk.

NEW LONDON, CONN.—W. H. Richards, Engr., has presented to the Board of Water and Sewer Commissioners a plan to carry a great part of the city's sewage out into Long Island Sound. Estimated cost, $15,000.

HARTFORD, CONN.—The following bids were received by the Board of Contract and Supply on Dec. 28 for the construction of 1,050 lin. ft. of sewer in Windsor St.—(a) 18-in. tile, (b) 15-in. tile, (c) manholes, (d) house connections, (e) branch connections: F. B. & W. H. O'Neil, Hartford, (a) $1.41, (b) $1.25, (c) $25, (d) $3, (e) 50 cts.; Berardino & Silvestri, Hartford, (a) $1.47, (b) $1.38, (c) $40, (d) $10, (e) 50 cts.; Charles H. Slocomb, Hartford, (a) $1.55, (b) $1.25, (c) $40, (d) $7.50, (e) $1; Hartford Paving & Construction Co., Hartford, (a) $1.70, (b) $1.60, (c) $55, (d) $10, (e) $2.25; John M. Ferranti, Hartford, (a) $2, (b) $1.75, (c) $25, (d) $10, (e) $2.25; Eveline Bros., New Britain, (a) $2.18, (b) $1.80, (c) $50, (d) $12, (e) 50 cts. The bids were referred to the City Engineer for computation.

BROOKLYN, N. Y.—We are officially advised that the EMPIRE CONTRACTING CO., 234 88th St., Brooklyn, has been awarded contracts by the Borough for constructing sewers in Hinckley Place, from Coney Island Ave. to Stratford Road; 75th St., from Eighth to Eleventh Aves.; Senator St., from First to Second Aves.; and in Second Ave., from 71st to 73d Sts.

NEW YORK, N. Y.—Bids were received as follows on Dec. 24 by Louis F. Haffen, Pres. Boro of The Bronx, for the construction of sewers: Antonio Manseuolli, 168 East 205th St., $28,940; Wakefield Construction Co., $36,540; Voorhees Sullivan, $45,925; John B. Malatesata, 3169 Jerome Ave., $45,148; P. J. Duffy, 2137 Broadway, $37,706; D. W. Moran, 562 Burnside Ave., $33,924.

PASSAIC, N. J.—The Sewer Committee of the City Council on Dec. 18 awarded the contract for a sanitary sewer in Highland Ave., between Dayton and Barbour Aves., to JOHN T. HARRON. There were two other bidders, James Maybury & Son and the De Vogel Contracting Co.

ELIZABETH, N. J.—Bids are asked until 8 p. m., Jan. 1, by the City Council for constructing a sewer in Linden Ave. The work includes 640 lin. ft. of 10-in. pipe sewer, caulked joints, 46 6-in. connection, four manholes, 46 ⅛ turns, 828 lin. ft. of 6-in. pipe to curb. N. K. Thompson is St. Comr.

CAPE MAY, N. J.—Harvey Bennett, Cape May, has submitted the lowest bid to the Council for the construction of storm sewers in the new Cape May tract.

SCOTTDALE, PA.—J. B. Hogg, of Connellsville, Pa., has been instructed by the Council to prepare plans for sewers in case in the future a disposal plant is ordered to be put in. The entire watershed surrounding Scottdale is now being surveyed. The sewage empties into Jacobs Crook, a sulphur stream, but in case it should ever clear the State will order sewage disposal works.

*CHARLESTON, W. VA.—Bids will be received by the Board of Affairs until Jan. 6 for constructing sewers here. Estimated cost, $30,000. W. A. Hogue is City Engr.

EAST POINT, GA.—Bids are asked until Jan. 19 by the city for the construction of about twelve miles of sewerage. Estimated cost, $20,000.

CLEARWATER, FLA.—The city has voted $15,000 of bonds for sewer construction, sewers to be of salt-glazed terra-cotta pipe.

MONTGOMERY, ALA.—The city has voted $25,000 of bonds for extending the sanitary sewerage system. W. M. Teague is Mayor.

BOGALUSA, LA.—ERWIN BROS., New Orleans, La., have been awarded the contract for constructing a sewer system here.

LOUISVILLE, KY.—The contract for the construction of Section D of the Beargrass interceptor, Contract 16, was awarded on Dec. 18 by the Commissioners of Sewerage to T. J. O'CONNELL, 218 South Ann St., Baltimore, Md., at about $40,000. Section D is about 2,000 ft. long, and extends from Shelby St. and Broadway to Logan St. J. B. F. Breed is Ch. Engr.

LANCASTER, OHIO.—The State Board of Health has approved plans for the construction of a new storm water sewer.

CANTON, OHIO.—The Council on Dec. 15 passed the ordinance providing for an issue of $24,800 of bonds for constructing a storm water sewer in Liberty St., from Saxton St. to Nimishillen Creek. J. A. Starrett is City Engr.

NEY, OHIO.—Plans have been approved by the State Board of Health for the construction of a sewerage system here.

COLLEGE HILL (Cincinnati post-office), OHIO.—J. A. Stewart, of Cincinnati, has prepared plans for the proposed sewerage system and sewage purification plant, for which the State Board of Health has approvel plans. Noted on Dec. 24.

WOOSTER, OHIO.—Bids are asked by the Board of Public Service until noon, Jan. 8, for constructing sewers in Spink St., from Stibbs to University Sts. C. W. Van Nest is Clk. Bd.

FORT WAYNE, IND.—We are officially advised that the contract for the construction of a sewer in the alley east of Short St. has been awarded to ANTON RIEG. Bids were opened by the Board of Public Works on Dec. 27. H. W. Becker is City Clk.

WINCHESTER, IND.—Bids are asked by the City Council until noon, Jan. 6, for the construction of a large sewer here.

HASTINGS, MICH.—The Common Council has passed a resolution for the construction of sewers in Green, Anover and Marshall Sts. James M. Patten is Clk.

GRAND RAPIDS, MICH.—The Board of Public Works on Dec. 19 let the contracts for the sewage pumping machinery. The BUFFALO STEAM PUMP CO., 490 Broadway, Buffalo, secured the contract for the pumps alone, not installed, at $27,370. The engines will be delivered here and erected by the Board on the day labor plan or by some local firm. The contract for the electrical equipment was let to the WESTINGHOUSE ELECTRIC MFG. CO., 209 Ninth St., Pittsburg, Pa., at $16,269. This includes the dynamos, their erection, wiring and electrical construction.

PEORIA, ILL.—The construction of new sewer systems is being considered by the Board of Local Improvements. Two systems are planned, one in the extreme lower and one in the extreme upper end of the city. Under a resolution introduced on Dec. 15 the Board and Engineering Department will proceed to prepare plans for a system that includes the territory embraced in the Eighth, most of the Sixth and a part of the Seventh Wards. Estimated cost, about $300,-000.

ST. PAUL, MINN.—The Board of Aldermen passed a resolution on Dec. 15 authorizing the issue of $150,000 of sewer bonds for the construction of main sewers here. L. A. Rundlett is City Engr.

RED WING, MINN.—A. R. Rhame, City Engr., has prepared plans for sewer extension in West End to include tile pipe 1½ miles long. Bids will be asked in the spring. Estimated cost, $30,000. Leon Meyers is Clk.

WINFIELD, KAN.—Bids are asked until 7.30 p. m., Jan. 4, by George W. Sloan, City Clk., for furnishing material and labor and constructing sewers in sewer districts Nos. 6 and 7. Charles M. Wallace is Mayor.

WICHITA, KAN.—B. C. Wells, Engr., City Hall Bldgs., is preparing plans for the construction of a vitrified pipe main sewer. Estimated cost, $50,000.

LEAVENWORTH, KAN.—Plans are being prepared by A. Maduska, Engr., Leavenworth, for the construction of sewers in District No. 9, to include 800 ft. of 10 and 15-in. pipe. J. H. Kirmeyer is City Clk.

FORT ROBINSON, NEB.—Bids for the construction of the sewer system and waterworks here have been received as follows: Tinsway & Garrand, Sheridan, Wyo., $17,-300; J. J. Hanighen, Omaha, Neb., $12,538. Capt. F. T. Arnold is Constructing Q. M., U. S. A.

REDFIELD, S. DAK.—The following are the bids opened on Dec. 14 by the city for constructing 2,160 ft. of 15-in., 1,920 ft. of 18-in. and ten manholes: James Kennedy, Fargo, N. Dak., $17,740; G. W. Haggart, Fargo, $16,987; A. I. Olding, Redfield, $18,-957; J. J. DUNNEGAN, Shenandoah, Iowa, $13,566 (awarded contract).

HUBBARD, TEX.—The city has voted $15,-000 of sewer and street improvement bonds. W. Q. Bowman is Mayor.

SHAWNEE, OKLA.—It is proposed to construct 6 and 8-in. vitrified pipe sewers here. Estimated cost, $25,000. F. D. Brown, of Shawnee, is Engr.

DENVER, COLO.—The following bids were opened on Dec. 14 by the city for constructing storm sewers and appurtenances in and for South Capitol Hill Storm Sewer District No. 2: Gibbons & Hughes, $62,633; Denver & Pueblo Construction Co., 67 Railroad Bldg., $64,218; William Porter, $67,417; National Construction Co., $68,365; Gaffy & Keefe Construction Co., $70,812; Commonwealth Construction Co., $70,697. J. B. Hunter is City Engr.

MARSHFIELD, ORE.—See item under Streets and Roads.

SALT LAKE CITY, UTAH.—Bids will be received until 8 p. m., Jan. 8 by the Board of Public Works, H. G. McMillan, Chn., for constructing pipe sewers in Sewer Extension No. 219. Louis C. Kelsey is City Engr.

TORONTO, ONT.—Plans for the construction of the trunk sewer and sewage disposal plant were approved on Dec. 15 by the Provincial Board of Health. C. H. Rust is City Engr.

STREETS AND ROADS.

(denotes that this work is advertised in Engineering News.)*

HARTFORD, CONN.—The contract for the construction of 3,750 lin. ft. of gravel road, including two 15-in. and one 30-in. tile culverts, on the Niantic & Lyme Tpk., in the town of East Lyme, bids for which were received at the office of the State Highway Commissioner on Dec. 23, has been awarded to the BENNETT N. BEARD CO., Shelton, Conn., at $2.10 per lin. ft. Other bidders were: Donahoe Bros., Middletown, $3.97; Lane Construction Corporation, Meriden, $2.95; A. Vito, Thompson, $3.27; Anderson & O'Neil, Chatham, $2.25; Ahern Bros., Putnam, $3.47; Grane & Redden, New London, $2.20; T. H. Gill Co., Winter Hill Station, Boston, Mass., $3.70.

NEW YORK, N. Y.—Bids were received as follows on Dec. 24 by John F. Ahearn, Pres. Boro. of Manhattan, for (a) furnishing and setting new curbstones in the parks, on Broadway, between 80th and 95th Sts., Borough of Manhattan; (b) furnishing and delivering 3,000 cu. yds. of mold on parks, in the Borough of Manhattan; (c) furnishing and setting new curbstones on the parks on Broadway, between 95th St. and 110th St., Borough of Manhattan: Bart Dunn, 444 East 68th St., (a) $8,166, (c) $8,282; Martin P. Lodge, 532 West 44th St., (a) $10,934, (c) $11,423; Cooper & Evans, (a) $8,649, (c) $8,-782; D. W. Moran, (a) $11,017, (c) $11,171; Atlanta Constructing Co., 230 East 42d St., (a) $9,856, (b) $1.90 per cu. yd., (c) $9,996; Charles L. Doran Constructing Co., 1015 Walton St., (b) $1.75 per cu. yd.; the New Jersey Co., (b) $3.00; Moran Touring Co., 17 Battery Place, (b) $3.90; William Young, (b) $1.75.

NEW YORK, N. Y.—Bids were opened on Dec. 15 by the Department of Docks and Ferries wor furnishing the labor and materials and repairing asphalt pavement on the North and East Rivers, together with all work incidental thereto. The contract for Class 1 was awarded to the SICILIAN ASPHALT PAVING CO., 41 Park Row, at $36,-000, and for Class 2 to the UVALDE ASPHALT PAVING CO., 1 Broadway, at $35,-720. Allen N. Spooner is Comr.

BROOKLYN, N. Y.—Bids were received on Dec. 9 by Bird S. Coler, Boro. Pres., as follows, for regulating, grading and paving with granite on a concrete foundation the roadway of West Ninth St., from Hicks St. to Henry St., together with all work incidental thereto; McCluskey & Carroll, 510 Lafayette St., Brooklyn, $5,151; Norton Gorman Co., 304 Douglas St., Brooklyn, $5,332; P. W. Grace, 44 Court St., Brooklyn, $5,400; M. F. Hickey, Second Ave., Brooklyn, $5,422.

ALBANY, N. Y.—The bids received on Dec. 22 by Frederick Skene, State Engr. and Surv., for construction of good roads were: Road No. 808, Norwich, Chenango County, one mile: B. H. Bud, Norwich, N. Y., $17,-151; C. H. Flanigan, Albany, $14,720; Newport Construction Co., Newport, N. Y., $14,-934; Edwin D. Baker, Binghamton, N. Y., $16,255; Delaware Construction Co., Sidney, N. Y., $16,269. Road No. 809, Smyrna, Chenango County, one mile: Edwin D. Baker, Binghamton, $9,019; A. Schaupp, Albany, $8,792; Delaware Construction Co., Sidney, $9,092. Contract for Road No. 808 awarded to NEWPORT CONSTRUCTION CO., Newport, N. Y., at $14,934, and for Road No. 809, to ALONZO SCHAUPP, Albany, at $8,-792.

LONG ISLAND CITY (L. I.), N. Y.—Bids were received as follows on Dec. 23 by Lawrence Gresser, Pres. Boro. of Queens, for paving with asphalt block pavement on a concrete foundation the roadway of Twelfth Ave., from Broadway to Jamaica Ave., First Ward: Continental Asphalt Paving Co., 79 Wall St., New York, $7,822; Hasting Pavement Co., 25 Broad St., New York, $8,014; Barber Asphalt Paving Co., 30 Church St., New York, $8,100.

ATLANTIC CITY, N. J.—The Mayor on Dec. 15 approved the ordinances providing for an issue of $40,000 bonds for paving and curbing.

MECHANICSBURG, PA.—The citizens on Dec. 15 voted in favor of issuing $60,000 of bonds for street improvements. Samuel E. Baschore is Boro. Secy.

WILKES-BARRE, PA.—Horn & Neff, of Slatington, Pa., have submitted the lowest bid to the State Highway Commission, Harrisburg, for constructing a macadam road 25,534 ft. in length, extending from Plymouth Borough line to Hancock Township line, at $70,786.

CLEARFIELD, PA.—REED & PATTON, of Curwensville, Pa., have secured the contract for constructing the state road from the Curwensville Borough line to Bloomington, and from Curwensville Borough line through the borough, at about $21,783.

HARRISBURG, PA.—Bids are asked by the State Highway Department until Dec. 31 for constructing 1,665 ft. of macadam road. Joseph W. Hunter is State Highway Comr.

BEAVER FALLS, PA.—The Council on Dec. 22 awarded the contract for paving Sixth St., from Seventh Ave. to Ninth Ave., with standard block to J. G. McGUIRE & CO., at $4,408.

NORFOLK, VA.—The Public Improvement Committee of the Councils has approved the resolution providing for paving Omohundro Ave. and extension and paving of Twelfth St. into Princess Anne Ave. Estimated cost, $86,880. W. T. Brooke is City Engr.

NEWPORT NEWS, VA.—The city has awarded the following contracts for paving work: J. W. DAVIS, of Newport News, for paving with Peebles' block; ALSOP & PIERCE, First National Bank Bldg., Newport News, for macadam and concrete curb and gutter; WASHINGTON ASPHALT BLOCK & TILE CO., South Capitol and R Sts., Washington, D. C., for block asphalt. Bonds for $100,000 have been issued.

*CHARLESTON, W. VA.—Bids will be received by the Board of Affairs until Jan. 6 for grading, curbing and paving certain portions of streets and alleys of the city. Estimated cost, $210,000. W. A. Hogue is City Engr.

ATLANTA, GA.—The construction of a boulevard from College Park to Atlanta, a distance of about six miles, is under consideration by the city.

PENSACOLA, FLA.—The only bid submitted to L. E. Thornton, City Engr., for constructing a road of Goulding cinders on Palafox St., from De Soto to Jordan St., is that of the C. H. Turner Construction Co., Pensacola, at $3,426.

ANNISTON, ALA.—The city has awarded the contract to J. S. CONNIFF & CO., of Anniston, for additional sidewalk paving at 87¾ cts. per sq. yd. J. D. Hunter is City Engr.

MOBILE, ALA.—The Board of Public Works has adopted plans for street improvements, which will provide for underground and covered canal drainage for northern and middle-western parts of city, and for paving of Spring Hill Ave. and Broad St. with wood blocks. Wright Smith, Engr., Mobile, has been directed to prepare estimates.

NATCHEZ, MISS.—Bids will be received until Jan. 4 by the County Commissioners, Natchez, for constructing a road.

VICKSBURG, MISS.—Bids are asked by Warren County until Jan. 7 for constructing a road from the city limits at Clay St. to Confederate Ave. in Vicksburg National Military Park. J. D. Laughlin is Clk.

CINCINNATI, OHIO.—Bids are asked until noon, Jan. 22, by the Board of County Commissioners for the improvement of Fenton Ave., from Cleves Pike to Harrison Pike, Green Township. Fred. Dreihs is Clk. Bd.

CLEVELAND, OHIO.—Bids are asked until 11 a. m., Jan. 16, by the Board of County Commissioners for grading, draining and improving Center road No. 2 from Miles Ave., at Randall to Bedford road, Bedford Village. William F. Black is Clk. Bd.

ZANESVILLE, OHIO. — Adams Bros., Zanesville, submitted the lowest bid on Dec. 18 to the Board of Public Service for paving McIntire Ave., at $13,716. Other bidders were: A. G. Pugh, Columbus, $18,846; E. A. Patterson, Columbus, $17,473; E. A. Patterson, Columbus, $17,210; John S. Woodrow, Zanesville, $17,158; T. M. Lynn, Zanesville, $16,486; W. S. Gregg & Co., Zanesville, $16,105; F. E. Brown, Zanesville, $16,-095; Petet & Abele, Zanesville, $15,594; Dunsweiler Bros., Zanesville, $13,918. E. H. Smith is City Engr.

MUNCIE, IND.—The Board of County Commissioners have awarded the contract for grading and graveling the Shroyer Road, near Selma, to A. MANOR, of Redkey, at $8,212.

NEWCASTLE, IND.—Bids are asked by the Commissioners of Henry County until 10 a. m., Jan. 5, for construction of a gravel road in Fall Creek Township and for 2½ miles of gravel roads in Harrison, Fall Creek and Jefferson Townships. W. L. Risk is County Audr.

LAFAYETTE, IND.—Bids are asked by the Commissioners of Tippecanoe County until Jan. 15, for the construction of a gravel road on the line between Tippecanoe and Warren Counties. John P. Forseman is County Audr.

INDIANAPOLIS, IND.—Bids are asked by Albert Sahm, County Audr, until 10 a. m., Jan. 16, for the construction of the county line gravel road.

WASHINGTON, IND.—Bids are asked by Thomas Nugent, County Audr., until Jan. 5, for the construction of five gravel roads.

FOWLER, IND.—Bids are asked by the Commissioners of Benton County until noon, Jan. 4, for the construction of two gravel roads, 15,840 and 10,560 ft. in length, respectively. Lemuel Shipman is County Audr.

BEDFORD, IND.—Bids are asked by Walter G. Owen, County Audr., until 1 p. m., Jan. 11, for the construction of 13,900 ft. of macadamized road.

MUNCIE, IND.—Bids will be received by the Commissioners of Delaware County until 10 a. m., Jan. 6, for the construction of two gravel roads in Center Township.

INDIANAPOLIS, IND.—Bids were opened on Dec. 9 by the Board of Public Works for the improvement of Alabama St. with asphalt and Parker Ave. with asphalt and brick gutter. Estimated cost, $12,000 and $11,500, respectively. The lowest bid was that of the Marion County Construction Co., Indianapolis. B. H. Miller is City Engr.

MOUNT PLEASANT, MICH.—Bids will be received until Jan. 4 by Augustus Borden, City Clk., for furnishing material and paving with either brick or asphalt macadam and constructing cement curb and gutter on portions of Main St. and Broadway.

DES MOINES, IOWA.—The J. W. TURNER IMPROVEMENT CO., Youngerman Blk., Des Moines, has secured the contract for paving with brick about 11,438 sq. yds. on a portion of Second Ave., at $25,000. G. D. Dobson is City Engr.

GRAND FORKS, S. DAK.—J. J. Smith, City Engr., has been directed to prepare plans and specifications for paving of portions of North Fourth, North Fifth, Third, South Sixth and Fifth Sts., International, Fourth, Reeves, Belmont and Eighth Aves.

KANSAS CITY, MO.—Bids will be received until Dec. 31 by the County Clerk, Kansas City, for grading, macadamizing and constructing necessary drains in portions of Levasy and Oak Grove road. Harry P. Koehler is County Highway Engr.

ST. LOUIS, MO.—Contracts for paving various streets and avenues here will be let by the Board of Public Improvements on Jan. 12.

ELDORADO, ARK.—The city will construct about twelve miles of concrete sidewalks. Bids will be asked at once.

HOUSTON, TEX.—The contract for placing concrete curbing along San Jacinto St., from McKinney to Leeland St., was awarded on Dec. 16 to McASHAN & WILLIAMS. There are approximately 2,800 lin. ft. of curbing to be placed, this including some already existing brick curbing, which has been declared available when the street paving begins.

GUTHRIE, OKLA.—The City Council on Dec. 13 awarded to the CHICAGO ASPHALT & RUBBER CO. the contract for 102,851 sq. yds. of asphalt paving and 98,294 sq. yds. of brick paving here.

MARSHFIELD, ORE.—Municipal improvements during the coming year will be made as follows: Paving, $50,000; planking streets, $45,000; sewers, $55,000.

SEATTLE, WASH.—The City Council has passed ordinances for street improvements as follows: Sixth Ave. and other streets, brick paving, $133,000; Third Ave. and other streets, asphalt paving, $33,000; Sixth Ave., West, cement walks, $5,500; Summit Ave. and other streets, asphalt paving, $74,-000; Market St. and other streets, planking, $7,800; 31st Ave., South, grading, $56,000. R. H. Thomson is City Engr.

SACRAMENTO, CAL.—The Board of Supervisors on Dec. 8 opened bids as follows for paving with asphaltum and macadam the Twelfth St. trestle, a distance of ¼-mile: Clark & Henery, Stockton, Cal., $8,296; Western Bridge & Construction Co., $10,703. G. N. Randle is City Engr.

NORTH VANCOUVER, B. C.—Bids will be received until Jan. 25 by the District Council. North Vancouver, for road machinery as follows: Compound steam 10-ton road roller with scarifier attached; hand truck for fuel oil and tool tender for roller; water cart with distribution pipe and suction hose; traveling van and two traction wagons of 4-ton capacity; portable compound toggle knapping motion stone breaker with screens, elevating and loading machinery; electric motors with belt and belt attachments for driving the stone breaker, etc.; air compressor of sufficient capacity to supply air for driving three pneumatic 2¼-in. drills, an air receiver of 34-cu. ft. capacity with necessary connections and pipes and three 150-ft. lengths of armored ¾-in. hose suitable for the pressure; three Sullivan or Little Giant Rock 2¼-in. drills with tripods, weights and complete set of drills each; Murphy air hammer rock drill with complete outfit. Donald Cameron is Dist. Engr.; Alex. Philip is Clk. Municipal Council.

MANUFACTURING PLANTS.

(denotes that this work is advertised in Engineering News.)*

WOONSOCKET, R. I.—A tract of land has been purchased by the Woonsocket Shuttle Co., and a mill may be erected. The concern was incorporated recently with $100,000 capital stock. John Johnston is Pres. and Treas.

PLAINFIELD, CONN.—The Lawton Mills Corporation, of Plainfield, Conn., manufacturers of cottons, has awarded to BENJAMIN F. SMITH, of Pawtucket, R. I., the contract for two buildings to be erected at the plant and materials will be brought at once to the plant preparatory to commencing operations the first of March on the construction. It is proposed to have the weave shed 227 × 150 ft., and the addition to the main mill, three stories high, 182 × 100 ft., solid mill construction, completed by September. The contract for from 16 to 23 double frame houses for employees of the mill, to be erected in the locality of the other 25 houses was awarded to HERMEDAS COUTOR, of Mossup, Conn. The work on these will be commenced when the other work is started, to be completed about the same time. The amount involved in the contracts is approximately $125,000.

THOMPSONVILLE, CONN.—The Upson Martin Carpet Co. has awarded the contract for constructing a building, 50 × 150 ft., 3 stories high, to MACY BROS. CO., of Waterbury, Conn. Work will be started at once.

BUFFALO, N. Y.—The Auto-Car Equipment Co. has had plans prepared for a factory building, 240 × 180 ft., one and two stories in height, of brick and steel with cement floors, to be erected on Elmwood Ave. near the New York Central Belt Line, at an approximate cost of $35,000. McCreary, Wood & Bradney, 607 Mutual Life Bldg., Buffalo, are Archs.

TROY, N. Y.—Articles of incorporation of the E. W. Marvin Co. have been filed with Thomas S. Fagan, County Clerk. The company will manufacture shirts, collars and cuffs and has a capital stock of $50,000, divided into 500 shares. The directors are Edward W. Marvin, Howard Williams, Willett Hawley and Fred Cohen, of Troy, and Douglas W. Mabee, Jr., of New York.

POTTSTOWN, PA.—J. V. Poley, C. E., 162 Second St., Royersford, Pa., is preparing plans for a brass foundry, 40 × 75 ft., for Mitchell & Van Meter.

GREENSBURG, PA.—The Wright Specialty Mfg. Co., of Greensburg, will erect a plant here. Charles Wright, 7 Broad st., South, Greensburg, is Vice-Pres. and Gen. Mgr.

WARREN, PA.—The Hammond Iron Works will build an addition to its plant soon, to consist of two buildings, 44 × 196 and 56 × 122 ft.

PHILADELPHIA, PA.—It is stated that the Miehpaul Mfg. Co. will double the capacity of its plant soon. The present equipment is 20 knitting and 15 sewing machines. The capital stock is $10,000. M. Lauphelmer is Pres. and Mgr.

Work will be begun immediately on a new wall paper plant to be built on Snyder Ave., between Water and Swanson Sts., for Becker, Smith & Page. A contract for the erection of the buildings has been made by Ballinger & Perrot, Archs., 1200 Chestnut St., with the ROYDEHOUSE-AREY CO., Delaware and Van Kirk Sts. The plant when completed will represent an outlay of about $200,000. The buildings will consist of a 3-story manufactory, 64 × 306 ft.; a similar building, 65 × 306 ft.; a 4-story building, 48 × 48 ft., and a 1-story power-house, 35 x 133 ft. All of the buildings will be of reinforced concrete and brick.

CHARLES W. DENNY, 1330 Arch St., has a contract for erecting a 3-story addition to the factory of the Reyburn Mfg. Co., 23d St. and Allegheny Ave. The contract price is $10,500.

NORFOLK, VA.—The Four Co., Ltd., is having plans prepared by B. F. Mitchell, Norfolk, for a candy factory and store building four stories high, of mill construction, with metal-frame windows. Cost, about $30,000.

WHEELING, W. VA.—Another new furnace is to be added to the Riverside works of the National Tube Co.; Frick Bldg., Pittsburg, Pa., in the Wheeling district. Plans have been prepared and it is expected authority to begin work will be given soon after the first of the year. When operating to capacity the Wheeling plant employs 3,500 men and the additional furnace will give employment to more. It is expected that the furnace will be ready for operation by next summer. The company also has plans for improvements at the other plants.

LOWELL, N. C.—It is stated that the Peerless Mfg. Co., of this city, will add 5,000 ring spindles to its present equipment of about the same number. This company manufactures 40 to 60 yarns, driving its machinery by electricity, and employing 75 persons. The proposed extension will require an expenditure of probably $100,000.

KINGS MOUNTAIN, N. C.—The Cora Cotton Mills, Kings Mountain, N. C., probably will add 10,000 spindles, which would mean the expenditure of nearly $200,000. The company now operates 10,560 ring spindles, etc., on the production of 13 to 40 warp and skein yarns.

CONCORD, N. C.—The management of the Kerr Bleaching & Finishing Works, of Concord, N. C., has decided upon details for rebuilding the plant, which was destroyed by fire several months ago. Contract for erecting the new buildings has been awarded to R. A. BROWN & SONS, of Concord, and they will at once begin building. New machinery and a portion of the old equipment now being rebuilt will be installed.

LEXINGTON, N. C.—The Dacotah Cotton Mills, of Lexington, N. C., have been incorporated with a capital stock of $150,000 and $125,000 paid in by C. A. Hunt, Jr., George Montcastle and Joe V Moffitt. Mr. Hunt will contract for the erection of a building capable of holding 10,944 spindles and accompanying looms, etc., but at first will install only 8,208 spindles and 250 looms, the product to be colored cotton cloth. Both steam and electricity are being considered for the power to be used. About 150 operatives will be employed when the mill is in operation. Machinery contracts will not be considered until spring.

LAURENS, S. C.—The Watts Mill, of Laurens, S. C., will enlarge its manufacturing facilities, expending probably $50,000 for the improvements. The management has decided upon the erection of a 250-ft. addition to the present building, increasing that structure to 900 ft. It has not been fully decided what number of spindles, etc., will be installed, but it will be a decided increase in the present equipment. The construction will begin at once, and other details of the enlargement probably will be stated soon.

THOMASTON, GA.—Press reports state that the management of the Thomaston Cotton Mills has decided to build a 250-ft. addition to its present mill and equip it with 5,000 spindles and 150 looms for manufacturing duck and sheeting. O. A. Robbins, of Charlotte, N. C., has been engaged as Engr.-Arch. and he has let contracts for the necessary machinery. The principal machinery contractors are the SACO & PETTEE MACHINE SHOPS, of Newton Upper Falls, Mass., and the FALES & JENKS MACHINE CO., of Pawtucket, R. I. The improvements will cost about $100,000.

ATLANTA, GA.—White Provision Co., W. H. White, Jr., Pres., 1 Wall St., will establish a packing plant and slaughter-house to manufacture lard, fertilizer, soap ingredients, etc. The company will erect a suitable building, plans for which have been prepared by D. I. Davis, Chicago, Ill. The building will have two stories and basement, 16,000 ft. of floor space with cold-storage plant on first floor. Capacity, about 4,000 hogs and 1,000 beeves. Cost, about $25,000. Noted last week.

MANCHESTER, GA.—The Manchester Cotton Mills have been incorporated for the purpose of building a 20,000-spindle mill at Manchester, Ga. Fuller E. Galaway, of La Grange, Ga., is interested. The company has engaged A. Francis Walker, Austell Bldg., Atlanta, Ga., as the Engr.-in-Charge, to furnish plans and specifications, to have the buildings erected, and to install the machinery. Mr. Walker probably will have the plans ready for bidders during January, so that contracts may be awarded. The company has a capital stock of $500,000.

BIRMINGHAM, ALA.—Ground has been broken by the Harbison-Walker Refractories Co., Farmers' Bank Bldg., Pittsburg, for a plant at Birmingham, Ala., which will have a capacity of 40,000 brick a day. Plans for the plant provide for the construction of reinforced-concrete buildings, which, with the equipment, will cost approximately $250,000.

KNOXVILLE, TENN.—The Knoxville Pure Milk Co. will erect two extensions to its plant and install additional equipment, it is reported. Cost of improvements, about $20,000.

NASHVILLE, TENN.—The Independent Ice Co. will erect a factory building, boiler and engine rooms, to cost $10,000.

BELLEFONTAINE, OHIO.—The Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. will enlarge the shops here after Jan. 1 and establish at Bellefontaine a division point. The roundhouse will be enlarged at a cost of $10,-000. It is stated that the shops at Springfield, Delaware and Sandusky will be merged in this city.

LA FAYETTE, IND.—The Cain & Galle Co., of Chicago, propose to erect, equip and operate a factory in this city to manufacture sanitary, galvanized iron delivery baskets. It is reported that bids will be in order as soon as a site is selected.

CICERO, IND.—The Indiana Bottle & Glass Co. will rebuild its large plant recently destroyed by fire.

ST. PAUL, IND.—Ira Martin is at the head of a company that contemplates the construction of an elevator.

OBLONG, ILL.—E. E. Crowden & Co., will rebuild the flour mill which was destroyed by fire recently at a total loss of $23,000.

MILWAUKEE, WIS.—Leenhouts & Guthrie, Archs., 104-102 Wisconsin St., have plans prepared for a 3-story ice cream factory building for the Luick Ice Cream Co.

CHIPPEWA FALLS, WIS.—The Chippewa Falls Woolen Mills Co., of this city, is planning to enlarge its plant to about twice the present size and doubling its capacity in the spring. The office of the company will be established at the mill.

BURLINGTON, IOWA.—H. J. Goddard, 424 Tama Block, Arch., has prepared plans and will receive bids for a 7-story factory building, 100 × 115 ft., and a 5-story warehouse, 60 × 115 ft., for Chittenden & Eastman Co. Estimated cost, $70,000.

WILLMAR, MINN.—Oman & Johnson, Willmar, Minn., will erect a foundry which will be operated in connection with their machine shop and which will be completed the first of next month. Gust Erickson will have charge of the foundry, it is stated, and will become a member of the firm, the name of which will be the Oman & [illegible]son Co. In addition to a general machine shop business, iron and brass castings will be made.

WICHITA, KAN.—The Wichita Light Co. has plans for a car [illegible] R. & of housing 22 cars. The site [illegible] capable of 260 ft. and is located at W[illegible] frontage Second St. Estimated cost, $15[illegible] Ave. and Chubbuck, Ottawa, Ill., Gen. M[illegible] H. E.

ST. LOUIS, MO.—The South[illegible] Works, of South Bend, Ind., a [illegible] Iron pany for the Oliver Chilled Plow [illegible] com- erect early in the year at th[illegible] ner of North Broadway and Warren S[illegible] ment house to cost about $150,000 [illegible] has a frontage of 80 ft. on B[illegible] the site 170 on Warren St., extending east [illegible] and bash tracks, and having termin[illegible] Wa- The plans for the factory are [illegible] cilities. The building will be a 6-story str[illegible] made. proof. Its equipment will be mo[illegible] fire- will be arranged for the display [illegible] and it of farm machinery. As soon as [illegible] storage is completed the Oliver Chilled Pl[illegible] building now located at the corner of 22[illegible] Works, Ave., will remove to it. Scott

SPRINGFIELD, MO.—The St. L[illegible] & San Francisco R. R. Co., J. F. Hin[illegible]y, Ch. Engr., St. Louis, Mo., is about [illegible] resume construction of its proposed shops [illegible] Spring- field, work on which was suspend[illegible] about a year ago. Estimated cost, $1,500,0[illegible]

VANDUSER, MO.—The Vanduser [illegible]hoop & Lumber Co., recently incorporated, [illegible]ill erect a frame building, 135 × 235 ft., it [illegible] stated, of ordinary construction, at a cost [illegible] $3,000. The company will install hoop m[illegible]inery to cost $10,000. Daily capacity, 50[illegible] booms. S. W. Shawan is Pres.; J. R. [illegible] Jr., Vice-Pres.; W. R. Nowels, Secy.; D. W[illegible]anley, Treas.

SHERMAN, TEX.—The Chicago, [illegible]ock Island & Pacific Ry. Co. will enlarge [illegible] shops at Sherman, expending about $2[illegible],000. J. B. Berry, Chicago, is Ch. Engr.

EL PASO, TEX.—It is stated that J. D. Dale and W. T. Owen, both of Dallas, Tex., have begun construction of a lard manufacturing plant in El Paso, to cost $2[illegible],000.

ORANGE, TEX.—The Yellow Pine Paper Co. will treble the present capacity of its plant, giving it daily output of 25 tons. Cost of improvements, including new machinery and additional buildings, about $130,000. R. S. Farwell, Consult. Engr., 309 Broadway, New York, will prepare plans.

EVERETT, WASH.—The Sumner Iron Works, of Everett, has decided to make improvements. It has been decided to add 7,000 sq. ft. of floor space to its machine shop, giving it a little over 15,000 sq. ft.

HOQUIAM, WASH.—The Hoquiam "News" states that James A. Karr, through J. S. McKee, has sold to Minneapolis men a tract of ground 300 × 1,050 ft. in North Hoquiam, to be used for site for a wood-working plant to be erected at cost of about $50,000. Land is to be cleared and ready by April 1 when construction will begin. All sorts of woodenware will be manufactured.

SUNNYVALE, CAL.—The Johnson Traction Engine Co. has secured a 9-acre tract adjoining the townsite of Sunnyvale. This factory site fronts on Fair Oaks Ave. The Traction Engine Co. will build a plant here, which will cover about five acres.

MISCELLANEOUS CONTRACTS.

U. S. RECLAMATION SERVICE.—Items regarding irrigation, canal projects, etc., will be found under Water Supply—Irrigation.

DITCH.—Goshen, Ind.—Bids are asked by the Commissioners of Elkhart County until 10 a. m., Jan. 16, for constructing ditch in Jefferson Township.

DITCH.—Willmar, Minn.—Bids are asked until Dec. 31 by John Feig, County Audr., at Willmar, for digging and constructing ditch No. 29. Estimated cost, $5,954.

WOODEN TUG.—Detroit, Mich.—Bids will be received until Jan. 21 by Lieut.-Col. C. McD. Townsend, Corps Engrs., U. S. A., for building and furnishing wooden tug.

TUGBOAT.—Detroit, Mich.—Bids are asked by Lieut.-Col. C. McD. Townsend, Corps Engrs., U. S. A., until 3 p. m., Jan. 21, for building and furnishing one wooden tug.

DITCH.—Delphi, Ind.—Bids are asked until Jan. 9 by the Commissioners of Carroll County for construction of a ditch in Jefferson and Tippecanoe Townships. J. D. Zartman, Supt.

DRAINAGE.—Almeda, Tex.—Drainage District No. 2, embracing land in vicinity of Almeda, will vote on Jan. 25 on issuance of $200,000 of bonds for drainage. A. E. Amerman is County Judge.

SUPPLIES.—New York, N. Y.—Bids are asked until 3 p. m., Jan. 7, by the Department of Parks for furnishing various supplies, lumber, etc., for parks, Boro. Manhattan, and Prospect Park, Boro. Brooklyn.

DREDGING.—Bayou Goula, La.—Bids will be received until Jan. 16 by J. W. Supple, Pres. Bayou Tigris Dredging Dist., for excavating and dredging 280,000 cu. yds. of dirt in the Bayou Tigris Drainage District, near the town of Bayou Goula.

DITCH.—Crawfordsville, Ind.—Milton L. Nees, County Surveyor and Drainage Comr., has let the contract for the construction of the Martin P. Gray ditch in Sugar Creek Township to S. G. MAXWELL, of Smartsburg, at $8,843. The ditch is located four miles west of Colfax and will be 16,995 ft. long.

CEMENT.—Chicago, Ill.—The Secretary of the Interior requests bids for furnishing 30,-000 bbls. of Portland cement for use in connection with the various irrigation projects of the Reclamation Service. The bids will be opened at the office of the Reclamation Service, 777 Federal Bldg., Chicago, Ill., on Jan. 18.

PILE PIER.—Kingston, Ont.—Bids are asked until Jan. 7 by Napoleon Tessier, Secy. Dept. Pub. Works, Ottawa, Ont., for coal-

struction of block and mass concrete dry masonry walls, renewal of old foundation timbers, of pile pier and widening of pile pier in front of Royal Military College, Kingston.

LUMBER.—New York, N. Y.—Bids were received on Dec. 22 by Geo. Cromwell, Pres. Richmond Boro., New Brighton, for furnishing and delivering 45 M. ft. spruce and 20 M. ft. yellow pine lumber, at city stable, Columbia St., West New Brighton. Contract was awarded to JAMES H. THOMPSON & SONS, Stapleton (S. I.), N. Y., at $1,917.

BASEBALL PARK.—Pittsburg, Pa.—The NICOLA BUILDING CO., Farmers' Bank Bldg., Pittsburg, has been awarded contract for new baseball park at Oakland for the National Baseball Club, Barney Dreyfuss, Pres. BOOTH & FLINN, LTD., Pittsburg, have grading contract. Charles W. Leavitt, Jr., 220 Broadway, New York, is Design. Engr.

DREDGING.—New London, Conn.—Bids were received as follows on Dec. 23 in the U. S. Engineer's office: John P. Randerson, Albany, per cu. yd., 26 cts.; T. A. Scott Co., New London, 35 cts.; Maritime Dredging Co., New York, 25 cts.; ATLANTIC DREDGING CO., 15 Whitehall St., New York, 13.8 cts.; T. Sanford Ross, Inc., Jersey City, 18.7 cts.

COALING STATION.—Philadelphia, Pa.—The Philadelphia & Reading Ry. Co. has awarded to the LINK BELT ENGINEERING CO., Nicetown, Philadelphia, a contract for the erection of a coaling station at Ninth and Green Sts., in connection with the elevation of the tracks on Ninth St., to cost approximately $80,000. The new coaling station will occupy a portion of the site of the old Ninth and Green Sts. passenger station.

REPAIRING DREDGE.—Savannah, Ga.—Bids were received by Col. Dan. C. Kingman, Corps Engrs., U. S. A., on Dec. 19, for repair work on the government dredge "Savannah." The lowest bid was that of the Kensington Shipyard Co., of Philadelphia, whose bid was $12,077. The other bids submitted were: Merrill-Stevens Co., of Jacksonville, Fla., $12,570; Newport News Shipbuilding & Dry Dock Co., $12,726; the Maryland Steel Co., of Sparrow's Point, Md., $13,182; and William Kehoe & Sons, of Savannah, $14,145.

OIL.—Roosevelt, Ariz.—The Secretary of the Interior has authorized the approval of a contract entered into by Louis C. Hill on behalf of the United States, and the SHATTUCK & NIMMO WAREHOUSE CO., of Los Angeles, Cal., whereby the latter agree to transfer from Mess, Ariz., to the Government oil tanks at Roosevelt, Ariz., 33,000 bbls., more or less, of crude fuel oil for use in connection with the Salt River irrigation project. The rate agreed upon for hauling this oil, $3.15 per bbl., will entail an aggregate expenditure of $103,950.

*SEAWALL.—Fort Morgan, Ala.—Bids were received as follows by Maj. H. Jervey, Corps Engrs., U. S. A., Mobile, on Dec. 24, for construction of seawall at Fort Morgan: Richard M. Murphy, New Orleans, La., $267,627; Charles Clarke & Co., Galveston, Tex., $284,384; Robert C. Storrie, Pensacola, Fla., $272,181; W. C. Spotswood, Mobile, $290,020; Christie & Lowe, New Orleans, La., $250,440; Blackstaff Engineering Co., Philadelphia, Pa., $270,635; Charles G. Ollinger, Mobile, $280,750. Itemized prices will be given next week under Contract Prices.

DREDGING.—Oakland, Cal.—Bids were received as follows on Dec. 12 by Lieut.-Col. John Biddle, Corps Engrs., U. S. A., San Francisco, for dredging in Oakland Harbor, Cal.—(A)Price per cu. yd.; (B) total for Section A (629,400 cu. yds.) and Section B (1,318,700 cu. yds.): N. R. Harris, 95 Market St., San Francisco, (A) 29.7 cts., (B) $525,126; R. A. Perry, San Francisco, (A) 30.9 cts., (B) $546,343; Pacific Coast Dredging & Reclamation Co., 6 East St., San Francisco, (A) 31 cts., (B) $548,111; Burrell Bridge & Construction Co., Oakland, (A) 36.9 cts., (B) $652,429.

DREDGING.—Wilmington, Cal.—The City Trustees have awarded contract to the NORTH AMERICAN DREDGING CO., 13 Park Row, New York, for dredging in municipal harbor, Sections A to G. There are $55,000 for the dredging, the remainder of the $100,000 bond issue being for bulkheading, wharves, and for improving the approach to the municipal wharf. The North American Dredging Co. bid as follows on the various sections: Section A, channel, 14 cts. per cu. yd; section B, channel, 11 cts. per cu. yd.; section C, channel, 11 cts. per cu. yd.; section D, basin, 12 cts. per cu. yd.; section E, basin, 11 cts. per cu. yd.; section F, basin, 11 cts. per cu. yd.; section G, basin, 13 cts. per cu. yd.

FREIGHT SUBWAY.—New York, N. Y.—Duncan D. McBean, Waldorf-Astoria Hotel, New York, has submitted a plan to the Public Service Commission for freight subway system in New York to cost about $130,000,000. Plans provide for construction of passageways by tunnels and subways to enable the Central Railroad of New Jersey, Baltimore & Ohio R. R., Lehigh Valley R. R., Philadelphia & Reading R. R., Erie R. R., Delaware, Lackawanna & Western R. R., New York, New Haven & Hartford R. R., and Long Island Railroad (Bushwick branch) to bring their passenger trains into a union passenger station in Manhattan located at the site bounded by Park Row, Oliver St., Cherry and Pearl Sts., or in that vicinity, there transferring their passengers to the rapid transit subway and elevated railroads leading to all parts of New York City; (2) to enable said railroads and also the Pennsylvania Railroad, Lake Shore Railroad, New York Central Railroad and the Harlem Railroad to deliver their freight cars in Manhattan and the Bronx there should be constructed combined railroad and roadway subways: In West St., from Liberty St to 22d St., thence in 11th Ave. to 42d St.; in South St., from Whitehall St. to Gouverneur Slip; in West Broadway, from Vesey St. to Fifth Ave; in Fifth Ave., north to 23d St. and Broadway; in Broadway, from 23d St. north to 34th St. and Sixth Ave.; in Sixth Ave., from 34th St. north to 59th St.; in 79th St., from First Ave. to Lexington Ave.; in 86th St., from Eighth Ave. to Broadway; in Seventh Ave., from 110th St. to 135th St.; in Willis Ave. (Bronx), from 134th St. to 148th St.

U. S. POSSESSIONS AND CUBA.

ENGINEERING SUPPLIES.—Panama.—The Isthmian Canal Commission has awarded contracts for the following engineering supplies, for which bids were opened on Dec. 21. 20,000 bbls. Portland cement, ALPHA PORTLAND CEMENT CO., New York, $28,-150. A quantity of flat machinery steel and 30,000 sheets of corrugated galvanized iron or steel roofing, to the U. S. STEEL PRODUCTS EXPORT CO., 30 Church St., New York, at $15,649 and $23,483, respectively. The bids on seven marine boilers have been referred to the Isthmus.

LUMBER.—Panama.—Bids were received as follows on Dec. 28 at the Isthmian Canal Commission for about 1,000,000 ft. B. M. of lumber, yellow pine or Douglas fir: G. Elias & Bros., Buffalo, N. Y., $28,021; fir, $27,057; 120 days. Arthur Gamwell, Seattle, Wash., fir, $33,755; 90 days. J. K. Joice, 164 Dearborn St., Chicago, $39,500. E. H. Lewis Lumber Co., Seattle, Wash., fir, $31,329. S. E. Naylor & Co., Gulfport, Miss., $25,869. Parrott & Co., 320 California St., San Francisco, $21,280, fir. Robt. R. Sizer & Co., Seattle, $28,196, fir. Bay Shore Lumber Co., Mobile, Ala., $52,552; $30,318. D. L. Gillespie & Co., Pittsburg, $31,567; $27,768. Bids are on pine unless otherwise stated.

FOREIGN CONTRACTS.

(To insure prompt attention, letters upon consular business should be addressed to the American Consul at ———. Such letters are opened and attended to by the person that may be in charge of the office. If addressed to the consul, personally, letters are forwarded to him, unopened, should he be absent, and a delay thus intervenes. If, in the meantime, he should have gone out of office the matter may wholly escape attention.)

RAILWAY.—Roumania.—Bids are asked until Jan. 20 by the Ministry of Public Works at Bucharest for the construction of a railway to run through the following districts: Buzau, Lopatari, Vintila and Voda. The price for this work is about $50,000.

ELECTRIC RAILWAY.—Russia.—Bids are asked until Jan. 24 for an electric railway concession in Baku.

WATER-WORKS. — Roumania. — Bids are asked until Jan. 5 at the Mairie de Giurgevo for a water-works system in the town of Giurgevo.

ELECTRIC RAILWAY, ETC.—Algeria.—Bids are asked by the Municipality of Bone until Feb. 15 for constructing an electric railway and power station.

RAILWAY SUPPLIES.—South Australia.—Bids are asked until 3 p. m., Jan. 19, by the Supply and Tender Board, Adelaide, for furnishing rails and fishplates.

FLOATING DOCK.—Egypt. — Bids are asked by the General Manager of the Egyptian State Rys., Cairo, until March 1, for the construction of a floating dock.

TRAVELING STEAM CRANE.—Spain.—Bids are asked until Jan. 3 at the Junta de Obras del Puerto, Cadiz, for supplying two traveling steam cranes for the Puntales Wharf, at Cadiz.

DRAINAGE.—South Australia.—A plan is under consideration for draining over 2,000 sq. miles in the southeast of South Australia. The Engineer-in-Chief's estimate for the construction of the main channel is about $1,500,000, of which expense the Government has offered to bear half.

STATION.—Italy.—The central railway station at Florence is to be enlarged at an estimated cost of $4,275,000. The additions will consist of the erection of a central building, with large waiting roms, offices, etc., and of two lateral buildings, the one on the right for the arrival of passenger trains and the other on the left for the mails, baggage, and other special services.

RAILWAY AND HARBOR IMPROVEMENTS.—Roumania.—The Council of Ministers have approved the action of the Minister of Finance in contracting a Government loan for about $15,000,000. In his report to the Council, the Minister of Finance points out that a large proportion of the above loan will be applied in connection with railways, viz., for the purchase of locomotives, cars, rails, etc.; also, in connection with the port of Constantza, for providing motors, elevators, tugboats, dredgers, cranes, etc.

PUBLIC WORKS.—Argentina.—The Direccion General de Vias de Comunicacion has been authorized to take the steps requisite for the construction of the railways from (a) Formosa to Embarcacion, (b) Barranqueras to Metan, (c) San Antonio to Nahuel Huapo, (d) Comodoro Rivadavia to Valle Hermoso. The Direccion de Obras Hidraulicas has been authorized to take the necessary steps for acquiring the flotilla for the navigation of the river Bermejo, and the Departamento de Hacienda is to place at the disposition of the

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Consulting and Contracting Engineers.

Specialists in Sewerage and Sewage Disposal.

NEW YORK, Oct. 3, 1908.

Engineering News Publishing Co.
220 Broadway, New York.

Gentlemen:

I have your letter of October 2nd.

I think you put too low a value upon your own paper as an advertising medium. The two insertions have brought a flood of applications for plans. Evidently all the contractors used to such work have heard of the proposed construction at Rye.

I do not think that it will be necessary to insert the advertisement again.

Yours truly,

G. Everett Hill.

Departamento de Obras Publicas $1,000,000 to defray the expenses of the foregoing works, according to the "Boletin Oficial," of Buenos Aires. A concession has been granted to the Ferrocarril Central Norte Argentino for the construction of a railway from Las Rosas to Costa Sacate, and the Ferrocarril Central Argentino has been authorized to construct the following lines: (a) From Bastre to Maria Juana; (b) From Las Rosas to Villa del Rosario; (c) from Cruz via La Guana, Dalmacio, Velez, Salto, San Augustin Molino, and San Jose to Ciudad de Cordoba; (d) branch from Rio Tercero to the Andine railway between Rio Cuarto and Chucul. The Clo. del Ferrocarril Buenos Aires y Rosario has obtained a concession to construct lines from Morteros to Hersilia and from Galves to Larreclisa.

A decree has been passed authorizing Abel J. Pagnard, Engr., to construct and work during a period of 60 years a commercial port in the mouth of the Arroyo Pareja, near Puerto Belgrano, Bahia Blanca. The works include the construction of docks, wharves, and warehouses for the loading and unloading of cargo, the installation of grain elevators, transporters, railway lines, etc. All the necessary material may be imported free of duty. The plans prepared by Senores Faglioni Hermanos for the construction of a port at Mar del Plata and the installation of railway lines have been approved. The inspeccion General de Puentes y Caminos has been authorized to construct two bridges, one over the Arroyo Leyes and the other over the Arroyo Portero, on the road from Santa Fe to Santa Rosa. The cost is estimated at about $65,000, and the Direccion de Contabilidad are authorized to invite tenders for the work.

A decree has been passed authorizing the execution of sanitary works and the erection of works for water supply in various towns, as follows: Sanitation works in the town of Bahia Blanca at a cost of $600,000; sanitation works in the town of Tucuman at a cost of $1,100,000; sanitation works in the town of Santa Fe at a cost of $500,000; water supply works in the town of Villa del Rosario at a cost of $350,000; water supply works in the town of Dolores at a cost of $250,000; water supply works in the town of Mercedes at a cost of $225,000; sanitation works in the town of Corrientes at a cost of $175,000.

CIVIL SERVICE EXAMINATIONS.

INSPECTOR'S ASSISTANT.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Jan. 13 to secure eligibles from which to make certification to fill vacancies as they may occur in the position of Inspector's Assistant (male), at $840 a year in the Bureau of Animal Industry, Dept. of Agriculture. Promotion to $1,000 a year is made after three years' satisfactory service at $840; promotion to $1,200 is made after three years' satisfactory service at $1,000 and after passing an examination for promotion. Age limit, 20 to 40 years. Application Form 304.

BACTERIOLOGIST.—New York, N. Y.—Applications will be received by the Municipal Civil Service Commission, 299 Broadway, until 4 p. m., Jan. 4, for the position of Bacteriologist (male and female). The examination will be held on Jan. 25, at 10 a. m. Candidates are expected to have taken a course in bacteriology in some medical college of recognized standing, and also to have had some experience in a reputable bacteriological laboratory. One vacancy exists in the Department of Health. Salary, $1,200 a year. Minimum age, 21 years. F. A. Spencer, Secy.

DRAFTSMAN, GAS METER TESTER.—Albany, N. Y.—The State Civil Service Commission will hold examination on Jan. 23, for position of Structural Draftsman, Public Service Commission, First District. $1,200 to $1,500 a year. Candidates must have had two years' practical experience in structural steel work. Candidates who have graduated from a school maintaining a standard satisfactory to the Commission will be credited with one year of the required experience.

An examination will be held at same time for position of Gas Meter Tester, Public Service Commissions. $75 to $90 a month. Candidates must be competent mechanics, familiar with the construction and testing of gas meters. The last day for filing applications for these positions is Jan. 16. Full information and application forms for any of the examinations may be obtained by postal card request to Chas. S. Fowler, Chief Examiner of the Commission, at Albany.

INDUSTRIAL NOTES.

SHNABLE & QUINN, general contractors, 1037 Stock Exchange Bldg., Chicago, announce that they have acquired the plant and equipment of Page & Shnable, and are prepared to undertake the construction of heavy concrete work.

THE CONCRETE STEEL CO., 29 Broadway, New York City, has secured the contract for furnishing Havemeyer bars for the new sewage disposal plant in Baltimore, Md., for which the general contractors are the New York Continental Jewell Filtration Co. There are about 1,000 tons of steel bars in this work, which is now in progress.

THE FOOS GAS ENGINE CO., of Springfield, Ohio, is furnishing a producer gas plant complete to the Standard Optical Co. for their new lens grinding department at Geneva, N. Y. The engine will be a 100-HP. 3-cylinder Foos vertical, from which power will be transmitted by rope drive. The producer will use Pennsylvania anthracite and is so arranged that a portion of the gas will be drawn off and used for annealing furnaces. The plant will be a very complete one and will contribute materially to the economical operation of the factory.

THE LYNCHBURG FOUNDRY CO., owning and operating the McWane Pipe Works, at Lynchburg, Va., and the Radford Pipe Works, at Radford, Va., has purchased 23 acres of land at Norfolk, Va., with deep water frontage of 732 ft., and belt line railway connections, on which to build a modern pipe foundry for export and coastwise trade. Details of construction have not yet been announced. Mr. H. E. McWane, Pres. of the company, together with his brother, J. R. McWane, Vice-Pres. and Gen. Mgr. of the American Cast Iron Pipe Co., Birmingham, Ala., will sail Jan. 6 for a trip to England, Belgium and Germany to visit pipe foundries in those countries.

THE RAYMOND CONCRETE PILE CO., of New York and Chicago, has been awarded the contract for placing Raymond concrete piles in the foundations of a compressor house that is being erected at the Erie Basin, Brooklyn, for the John N. Robins Company, Wm. T. Donnelly, Engr.; C. F. Bond Co., Gen. Contractors. Another contract awarded to the Raymond Company calls for the placing of Raymond concrete piles in the foundations of Public School No. 17, which will occupy a site extending through from West 46th to West 47th St., between Ninth and Tenth Aves., New York. C. B. J. Snyder, Arch., Bd. of Education; Clarke & Stowe, Gen. Contractors.

THE SANDUSKY PORTLAND CEMENT CO., of Sandusky, Ohio, is supplying its white Portland cement for use in the following important contracts: For exterior cement stucco on Davis-Schonwasser Bldg., San Francisco, Cal.; in mausoleum being erected at Swanton; Masonic Temple Bldg., St. Louis, Mo.; for lining and finishing swimming pool at Sanford Public Bath, St. Louis, Mo.; in work on the Capitol Bldg., Santa Fe, N. Mex. It is also furnishing its waterproof compound in the following important work: Presbyterian Hospital, Chicago, Ill.; New Washington Hotel, Seattle, in basement floor work; on John Jacob Astor estate, Rhinebeck, N. Y.; new City Insane Asylum, St. Louis, Mo.; in city reservoir construction at Oil City, Pa.

THE RECEIVERS of the Wabash-Pittsburg Terminal have awarded to the American Locomotive Co. a contract for twelve locomotives, to cost approximately $204,000. Delivery will be made in 90 days. An additional contract has been let for the building of a 100-ton wrecking crane, with equipment, to cost $20,000. An order for four locomotives, to cost about $68,000, will be placed in the near future for use on the West Side Belt railroad. Each of the engines ordered will have 45,000 lbs. tractive power. The weight on the eight driving wheels will be 205,000 lbs.; the weight of the engine will be 233,000 lbs. and the total weight of the engine and tender, loaded, will be 387,000 lbs.

TRADE PUBLICATIONS.

PIPE COVERING.—H. W. Johns-Manville Co., 100 William St., New York City. Paper; 6½ × 5½ ins.; pp. 6; illustrated.

This pamphlet contains sectional views of asbestos, magnesia and cellular coverings with explanations of the purposes for which each type is best suited.

FRICTION CLUTCHES.—The Hill Clutch Co., Cleveland, Ohio. Catalog "G." Paper; 6 × 9 ins.; pp. 24; illustrated.

This booklet contains price-lists of complete clutches and parts and tables showing dimensions and horse-power. In the Hill clutch, a cast-iron rim within the pulley rim is gripped by several pairs of jaws faced with hard wood blocks. The motion of the jaws is produced by a powerful toggle action.

OFFICE CABINET SUPPLIES.—The Globe-Wernicke Co., 418 Main St., Cincinnati, Ohio. Catalog No. 907. Paper; 6 × 9 ins.; pp. 58; illustrated.

In this catalog are listed supplies for use in connection with filing cabinets, including indexes and transfer cases for flat letter files; folders, guides and transfer cases for vertical filing cabinets; and supplies for card index, document, check and mercantile report filing cabinets.

AIR COMPRESSORS.—National Brake & Electric Co., Milwaukee, Wis. Publication No. 386. Paper; 6 × 9 ins.; pp. 24; illustrated.

Stationary and portable motor-driven compressors, both belted and direct connected, are described and illustrated in this booklet. These compressors are intended for industrial service and claimed to excel in simplicity of design and ready accessibility. Tables of dimensions and capacities are included.

CHAIN BLOCKS AND ELECTRIC HOISTS.—Yale & Towne Mfg. Co., No. 9 Murray St., New York City. Paper; 6 × 9 ins.; pp. 70; illustrated.

An introductory chapter gives a brief history of the development of the Weston chain block and compares the differential, duplex and triplex blocks made by this company, discussing the questions governing the choice of type for different purposes. Trolleys, cranes and overhead track systems are shown with lists of prices. Hand power hoists are made up to 20-ton capacity and electric hoists up to 30 tons.

SPIRAL RIVETED PIPE.—American Spiral Pipe Works, P. O. Box 485, Chicago, Ill. Catalog No. 5. Paper; 8 × 10¼ ins.; pp. 78; illustrated.

The numerous uses to which this type of pipe has been put are shown by photographs of actual installations, supplemented by facsimile blue-print maps and profiles of long pipe lines. There are illustrated price-lists of pipe and fittings and a list of companies using this make of pipe. Expansion joints, ball joints, slip joints and forged steel bolted joints are illustrated and described. In the final pages are tables relating to water flow and explanations of the weir dam and miners' inch methods of measurement.

TECHNICAL PAINTS.—The Arlington Manufacturing Co., Canton, Ohio. Paper; 4 × 9 ins.; pp. 20.

This concern is sending out a catalog of "technical" paints particularly intended for the use of engineers and architects. The line includes the usual standard lead and structural paints, primers, car and building paints, stains, machinery colors, varnishes and enamels. In addition there are two specialties for which much is claimed. One is an elastic, impervious protecting coating for steel work. The other is a paint that will adhere to galvanized surfaces.

ELECTRIC POWER AND LIGHTING APPARATUS.—General Electric Co., Schenectady, N. Y. Bulletins. Paper; 8 × 10½ ins.; illustrated.

Bulletin 4620 describes in [illegible] pages the pieces of apparatus used in the [illegible] series, luminous-arc, rectified-current [illegible] lighting system.

Bulletin 4631 has 18 pages [illegible] series alternating-current, enclosed [illegible] direct-lighting system.

Motor-generator sets are described in Bulletin 4633. These are for [illegible] alternating to direct current, or the reverse, and for converting direct current [illegible] voltage to direct current at a different voltage. Such machines are of 0.2 to 1,500 kw. in capacity. Machines are also described for changing alternating current of one periodicity to alternating current of different periodicity. These are commonly called "frequency changers."

The line of fan motors for 1908 appears in Bulletin 4632. This line embraces motors for both alternating and direct current, in desk, bracket, ceiling, floor-column and counter-column types of standard sizes. It lists also ventilating motors and miscellaneous small power motors for alternating and direct current, as well as various supply parts of the standard fan motors.

In pamphlet 3715 (5¼ × 7¾ ins.) is described mercury arc rectifiers for telephone-battery charging. The points of superiority which this outfit is claimed to have over the general motor-generator sets, rotary converters, and electrolytic rectifiers for charging central telephone batteries, are reliability, freedom from line disturbances, high efficiency, low first cost, low cost of maintenance, simplicity of operation, noiseless operation and economy of floor space.

The booklet 3701 (6 × 3½ ins.) shows the line of snap switches, indicating and non-indicating, flush switches of the rotary and push button type, pendent and ceiling switches as made by this company.

For other Proposal Advertisements see pages 47, 48, 49, 50, of Advertisements and Construction News page 236.

TRAVELING CRANES.

Grand Rapids, Mich., Dec. 28, 08.

Office of the Board of Public Works.

Sealed proposals will be received at the Office of the Board until January 7, 1908, at 8:00 P. M., for furnishing, also furnishing and erecting one 3-ton, two 4-ton and one 6-ton hand operating traveling cranes for sewage pumping stations according to plans and specifications on file at the Office of the City Engineer.

The Board reserves the right to reject any or all bids.

Each bidder shall deposit with his proposal a certified check or certificate of deposit payable to the order of GEORGE C. PEIRCE, President, in the sum of five (5) per cent. of his proposal, to be forfeited to the City of Grand Rapids in case he shall fail to enter into contract in accordance with his proposal, should his proposal be accepted by the Board of Public Works.

By order of the Board.

WILLIAM M. GORMLEY,
Pres. pro tem.

SAMUEL A. FRESHNEY,
Secy. and Gen. Mgr.

L. W. ANDERSON,
City Engineer.

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Volume 60.
No. 27

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Write for prices and cuts

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SAN FRANCISCO
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ENGINEERING NEWS

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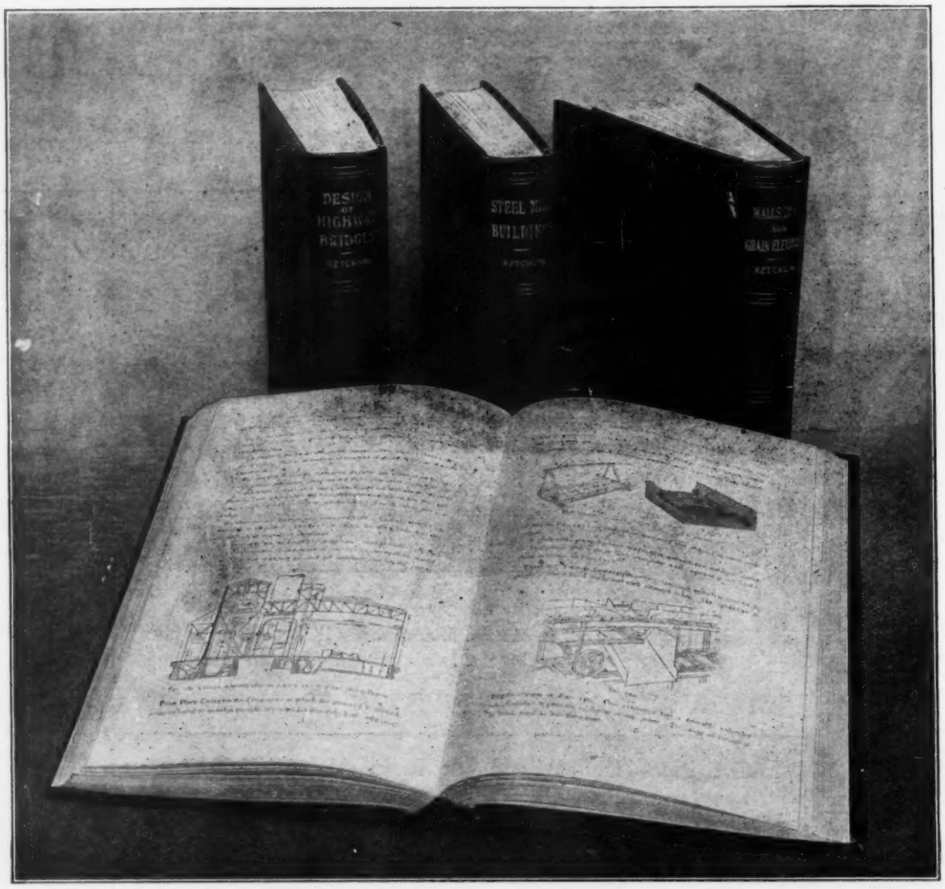

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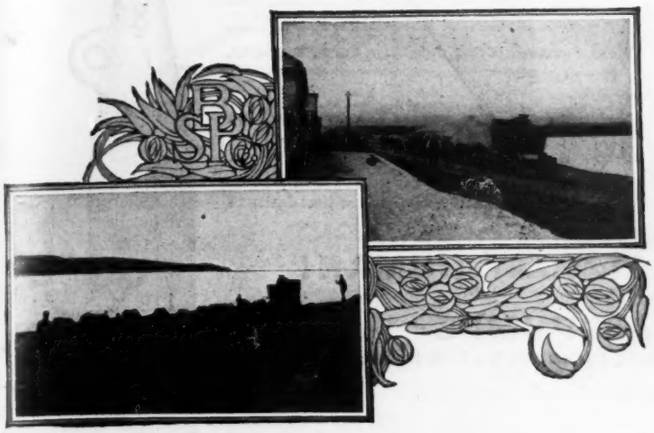

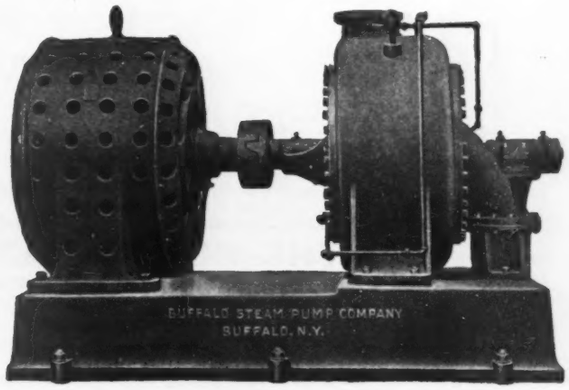

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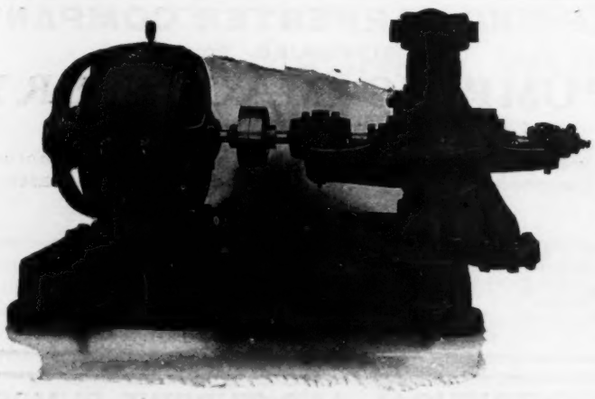

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PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION

COMPLETE PLANTS

ALMOST HUMAN!

The following correspondence speaks for itself:

DEPARTMENT OF COMMERCE AND LABOR.
LIGHT-HOUSE ESTABLISHMENT.

Office of Inspector, 8th District,
NEW ORLEANS, LA., *December* 1, 1905.

J. C. Spotts, Esq., Agent, Emerson Steam Pump Co., New Orleans, La.

DEAR SIR:—I am in receipt of your two letters of the 29th and 30th of November, and take pleasure in complying with your request for a general opinion as to your Emerson pumps; and I have no hesitation in saying that I consider the pump the finest thing I ever saw in that line. The Light-House Tender Magnolia was very seriously damaged on the night of the 26th of October in a collision. She was beached; that is, her stem was run on the mud in the Mississippi River, and the entire forward part of the ship was filled with water. The ship's pumps were unable to handle the volume of water at all. Your pump, a three-inch pump, was installed, and, when started, it kept up its work perfectly until the ship was dry-docked. It did not fail, and it acted as near a human being as I ever saw a piece of machinery do. Very respectfully,

JAMES H. SEARS, *Commander, U. S. N.*, Inspector, 8th L. H. District.

DEPARTMENT OF COMMERCE AND LABOR.
LIGHT-HOUSE ESTABLISHMENT.

Office of Inspector, 8th District,
NEW ORLEANS, LA., *January* 31, 1906.

The Emerson Steam Pump Co., Prince Street and Strand, Alexandria, Va.

SIRS:—I am in receipt of your letter of January 17, expressing your appreciation of my good opinion of your pump, and asking me if you can use my letter. It gives me pleasure to state that you can use my letter, and with all my heart, because I believe in being outspoken about a good thing. Respectfully,

JAMES H. SEARS, *Commander, U. S. N.*, Inspector, 8th L. H. District.

The pump that can empty the hold of a leaking vessel and KEEP IT DRY can keep the water down in a cofferdam, sump or mine.

Contractors **everywhere** are buying, using and **becoming enthusiastic** over

THE PUMP THAT IS ALMOST HUMAN!

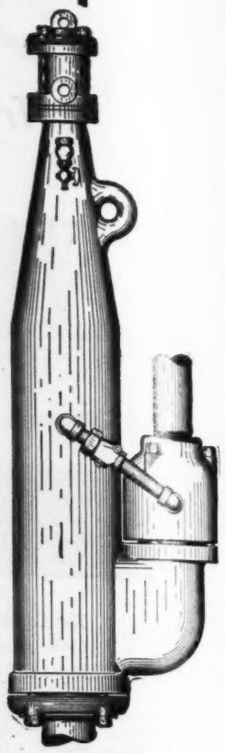
Send for our Catalogue C and the PROOF of the above statements.

EMERSON STEAM PUMPS

both "Standard" and "Junior" types, and **Emerson Quick-Cleaning Strainers** and **Foot Valves** have made friends for themselves, by sheer merit, everywhere.

They are in stock, ready for **immediate shipment**, at our works and at all our agencies.

Emerson "Standard." Lift, 150 feet.



Emerson "Junior." Lift, 101 feet.

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Cleveland, O., W. M. Pattison Supply Co.
Chicago, Ill., G. H. Olmstead, 407 Dearborn St.
Pittsburg, Carlin Machinery and Supply Co., Lacock and Sandusky Sts.
Philadelphia, Pa., J. J. Shannon & Co.
Stuttgart, Ark., Arkansas Engineering and Machinery Co.
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Portland, Ore., Alvin Smith, 182 Morrison St., Pacific Coast Representative.
Montreal, Can., Canadian Fairbanks Co.
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Winnipeg, Man., Canadian Fairbanks Co.
Vancouver, B. C., Canadian Fairbanks Co.
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Sydney, Australia, Australian Machinery Trust.
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The Emerson Steam Pump Co.

Offices and Works:

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Jeanesville Turbine Pumps

15,000 H. P. Boiler Feed Unit 8-inch, 5-stage Jeanesville Turbine Pump. Direct connected to 300 H. P. Terry Steam Turbine. Discard your "Steam Eaters" and buy a sure "Money Saver." We build units in all sizes.

We are prepared to furnish HEAVY CASTINGS. Get our estimates.

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For Every Service, with Balanced Piston Valves

Cross Compound Crank and Fly Wheel, Triple Expansion, Compound and Simple; also Jet and Surface Condensers

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Steam Turbine Driven

TURBINE AND TURBO-VOLUTE PUMPS

Fit Many Services Perfectly

WE BUILD THE COMPLETE UNITS

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High Grade **PUMPS** Vacuum Boiler Feed

Pressure and Tank Service

Condensers, Feed Water Heaters, Water Cooling Apparatus

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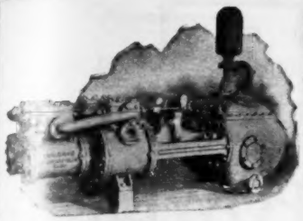

Dean Steam Pumps

Single and Duplex Pumps, Boiler Feeders, Water Supply Pumps, Fire Pumps, Air Pumps and Condensers, Hydraulic Pumps

DEAN BROS. STEAM PUMP WORKS
INDIANAPOLIS, IND.

DIAPHRAGM PUMPS

For either side or bottom suction and with reversible lever and spout.
The rubber diaphragm eliminates plungers. Will not clog, and especially fitted for raising water from ditches and other very muddy places, as sand, gravel, etc., will not clog the valves.
When making inquiry, please mention conditions under which the pump will have to work.

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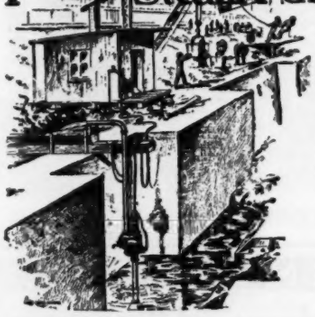

HANG IT!

where you will, on a beam, derrick boom, tripod or set it anywhere without special foundation, then turn on the steam—no engine, belt, oil, packing, special foundation or further attention required.

Especially well adapted for draining Foundations, Cofferdams, Sewer Trenches, Quarry Pits, etc., and any other place where the water contains much **mud and grit.**

Simple Handy Durable Effective

Send for illustrated descriptive catalogue telling all about them.

Pulsometer Steam Pump Co.
18 BATTERY PLACE, NEW YORK
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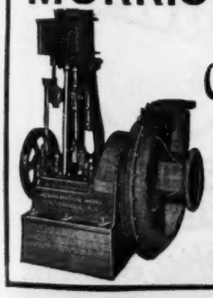
BALDWINSVILLE, N. Y.
Established 1864



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Correspondence invited.

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STEAM AND HYDRAULIC TURBINES OF SPECIAL DESIGN
CENTRIFUGAL PUMPING MACHINERY SPECIAL HEAVY MACHINERY
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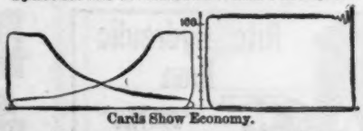
All parts readily accessible. Valve and Cylinder Covers easily removed. No Space for Air to collect in Water Passages.



Cards Show Economy.

Questions relating to special conditions or service will receive careful attention.

Mention Lift Length of Intake and Working Pressure when writing

Address
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SOUTH BETHLEHEM, PA.

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VULCABESTON weighs 40 per cent. less than ordinary high pressure packings, therefore you get a piece almost half again as large per pound. While a piece of ordinary high pressure packing, weighing 7 pounds, would be only about one yard square, a piece of **Vulcabeston** of the same weight would be nearly 1 1-2 yards square. That is why it is the cheapest high pressure packing.

VULCABESTON PACKING is made of **asbestos.** That is the reason it will not burn, char, harden or crack under the highest pressure. Being vulcanized under extremely high pressure, it has great tensile strength. It is pliable and compressible, consequently makes a tight joint on smooth or rough flanges.

Not affected by acids, gases, ammonia, etc.

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ARE ECONOMICAL
in the use of Compressed Air, and are also equally efficient with Compressed Air as with Steam

On account of the small clearances there is little leakage. Every particle of compressed air or steam, whichever used for power, is utilized.

They cannot exhaust the steam or air from behind the piston before the piston has reached the end of its stroke and pushed back the reversing lever.

The parts are properly proportioned and the least possible loss ensues from wire drawing.

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There is no multiplicity of moving parts to add to the frictional resistance.

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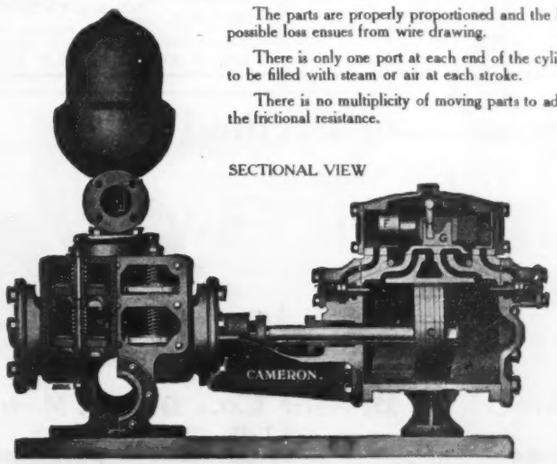

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NOTE—We also build Jet, Surface and Barometric Condensers, and desire to bid upon them

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Prescott Condensing Systems
or
Independent Installations

¶ *An instance of their economy*—Prescott Barometic Condensers in service in Central Power Stations are giving **28"** vacuum without the aid of an air pump. ¶ Send for our Catalogue 20-K, which also shows pumping machinery for all services.

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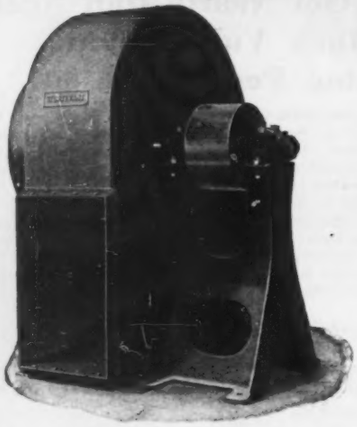
Independent Air Pump and Condenser

84



FOR THE MOVEMENT OF AIR IN LARGE VOLUMES

Sturtevant Fans are designed to secure the maximum capacity with the minimum expenditure of power. They are built throughout of heavy steel plate, stiffly ribbed with structural steel; are provided with continuous self-oiling boxes and with carefully balanced fan wheels.

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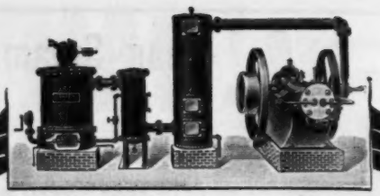
Designers and Builders of Heating, Ventilating, Drying and Mechanical Draft Apparatus; Fan Blowers and Exhausters; Rotary Blowers and Exhausters; Steam Engines, Electric Motors and Steam Turbines; Pneumatic Separators, Fuel Economizers, Forges, Exhaust Heads, Steam Traps, etc. 504



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1 to 1¼ lbs. Anthracite Pea Coal per H. P. per hour

The Backus Suction Gas Producer Plant and Gas Engine

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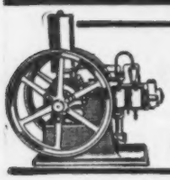

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OIL ENGINES

Marine, 2 to 200 H. P. Stationary, 2 to 200 H. P.
Over 50,000 H. P. in operation
USE KEROSENE, FUEL OILS, ALCOHOL AND CRUDE OIL
Direct Connected Generators, Pumps, Hoists, etc. *Send for Catalogue*
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"Pumps that Pump"

(The Kingsford Kind)

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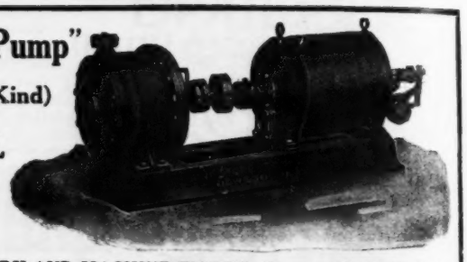

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"A B C" Engines

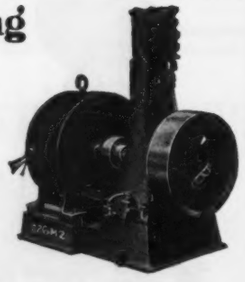
are becoming recognized as **standard** of excellence for **Exciter Outfits** and **Generating Units**

We direct connect to any standard make of dynamo

Absolutely Noiseless Simply Perfect

Entirely Enclosed and Self Oiling

Catalog 222 EN will interest you



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OTTO ENGINES

Otto Suction Gas Producers and Otto Engines

are reliable and can be operated by men of ordinary intelligence.

J. A. Witter, Engineer for the Beaver Crossing Electric Light & Power Co., Beaver Crossing, Neb., writes:

"Please send me a book of instructions on handling and running your gas producer and engine. I have been running this one on horse sense, but that might not work at all times. Plant works fine."

This man, without special instructions but with the use of "horse sense" causes his plant to work fine. There is a volume of praise for "OTTO" machinery in Mr. Witter's short letter.

OTTO OTTO

OTTO GAS ENGINE WORKS, Phila, Pa.

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Downie Double Stroke DEEP WELL PUMPS

Steam or Electric Driven or Geared from Shaft, are offered for service in elevating large quantities of water from deep Artesian Wells. Single Stroke Pumps for lighter deep well work.

Catalog No. 6

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THE JOHN H. McGOWAN CO. CINCINNATI

SIMPLE COMPOUND & COMPOUND CONDENSING ELEVATOR & WATER WORKS PUMPING ENGINES

60 YEARS' EXPERIENCE

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SHOW 28 PER CENT. THERMAL EFFICIENCY

SOME OF THE REASONS: All valves mechanically operated, permitting the cylinder to be filled with fuel charge at atmospheric pressure. Compression space determined by careful experiment for each particular fuel. Correct design and careful workmanship reduce friction losses. Foos wipe spark igniter, positively driven, never fails. Catalogue No. 43 tells the rest of the story.

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1½ to 150 H.P. For Gas or Gasoline

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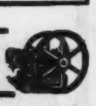

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Town Water Works

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No Attention—No Expense—Runs Continuously

Operating under 18 inches to 50 foot fall. Elevates water 30 feet each foot of fall. 6,000 in successful operation. Sold on 30 days' trial. Catalog and estimate free.

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PUMPS FOR EVERY DUTY

THE HOOKER STEAM PUMP CO.
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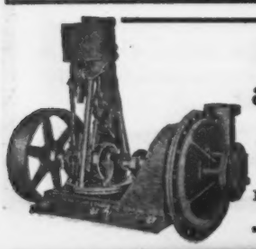
CENTRIFUGAL PUMPS

AIR COMPRESSORS

PUMPS

STEAM ELECTRIC POWER

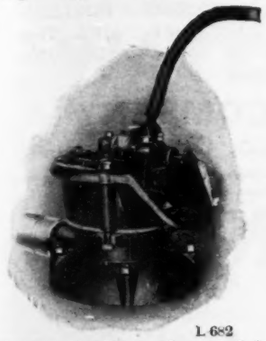
Erie Pumps and Engines



Have a world wide reputation for durability and high efficiency. Don't experiment, buy Erie Pumps and Engines and get results.

ERIE PUMP & ENGINE CO.
Erie, Pa.

Hercules Diaphragm Trench Pumps



L 682

Water containing sand or mud does not affect the operation of our trench pumps.

Nos.	1	2	3
Size of suction, ins.,	2½	3	4
Capacity, per hour,	2000	4000	6000

MANUFACTURED BY

JAMES B. CLOW & SONS

CHICAGO NEW YORK HAVANA

CLOW FLEXIBLE BALL JOINTS

for laying submerged lines across rivers and other waterways and for intake pipe, etc. The ball is carefully machined and reinforced

MANUFACTURED BY

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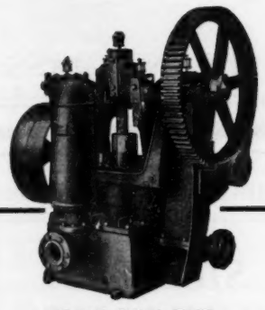

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the fuel expenses, and you will find a saving of 50 per cent. by using

Goulds Power Pumps

Built for every service—water works, deep wells, boiler feeding, fire protection, general water supply, etc.

Write for complete catalog.

THE GOULDS MFG. CO.

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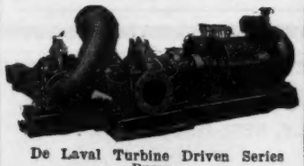

De Laval Turbine Driven Series Pump.

Steam Turbine Motors
Steam Turbine Dynamos
Steam Turbine Blowers
Steam Turbine Centrifugal Pumps
Electric-Motor Centrifugal Pumps

Send for Catalogue No. 21

DE LAVAL STEAM TURBINE CO.
TRENTON, N. J.

WEARWELL LEATHER PACKINGS

YOU HAVE PACKING TROUBLES

WE HAVE EXPERIENCE

LET'S SWAP

Send for Descriptive Booklet and Samples

DETROIT LEATHER SPECIALTY CO., INC.

900 Beecher Avenue

DETROIT MICHIGAN

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L. H. COLLINGWOOD, 503 Columbia Bank Building, Pittsburg, Pa.
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VULCAN SUPPLY CO., 120 Sycamore Street, Cincinnati, Ohio

Curtis Turbine Generating Sets for electric lighting

The best kind of artificial light for outdoor or indoor work is electric light, and the best way to furnish electric light to a construction job is with Curtis Steam Turbine generating sets. This is on account of the small space taken up by the set, its small weight, the economy and simplicity of operation.

A 20 kilowatt Curtis Turbine generating set weighs 1850 pounds, and takes a floor space about 2 x 6 feet. There are so few parts and the whole is so strongly built that the set will run for hours without attention.

If you use Electric Light in large or small quantities you can use a Curtis Steam Turbine Set profitably. They are made in sizes from 15 kilowatts upward.

Perhaps our booklet 312-D would interest you. Shall we send it?

General Electric Company

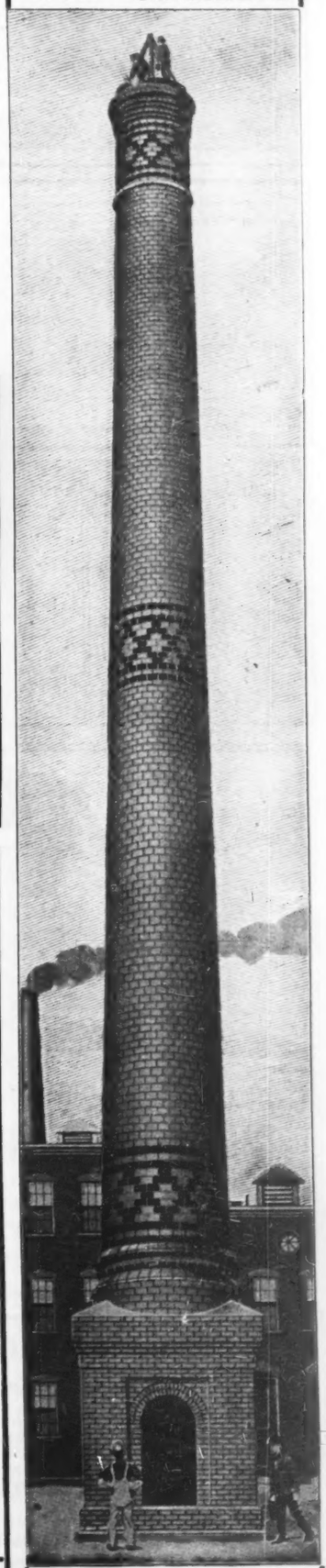
Principal Office: Schenectady, N. Y.

Sales Offices in All Large Cities

1804

PERFORATED RADIAL BRICK CHIMNEYS

OVER 3500 IN USE



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Chicago, 822 Marquette Bldg.
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Boston, Oliver Bldg., 141 Milk St.
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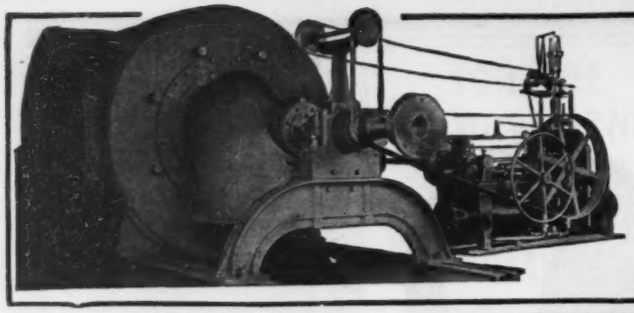

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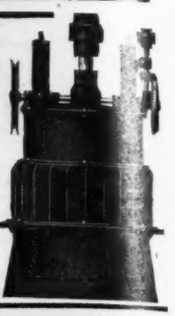

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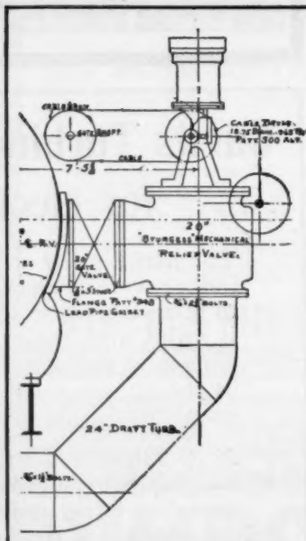

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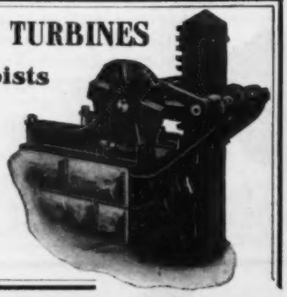

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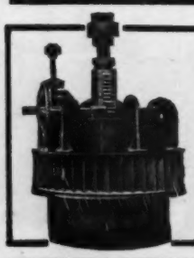

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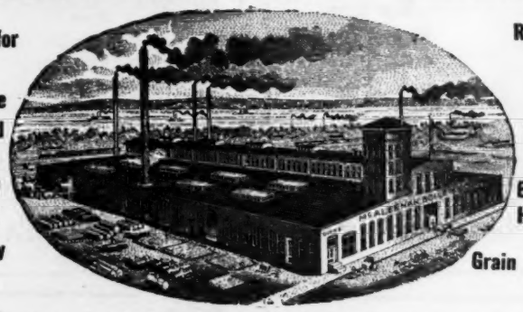

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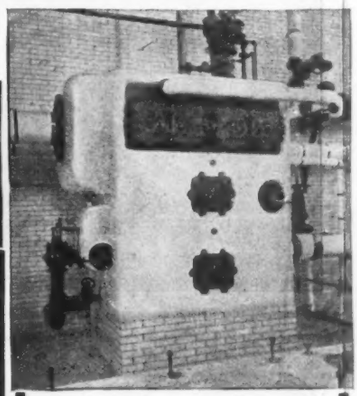

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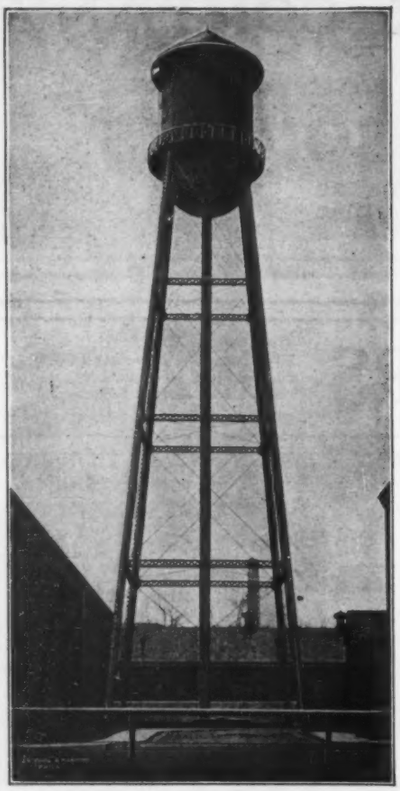

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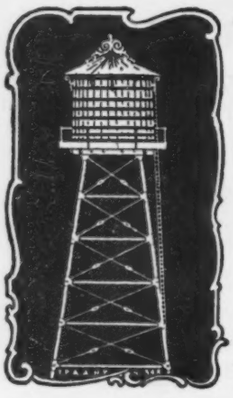

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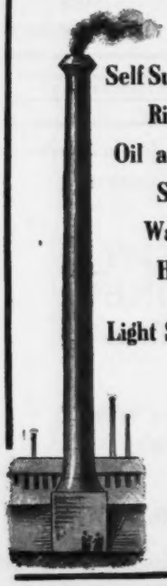

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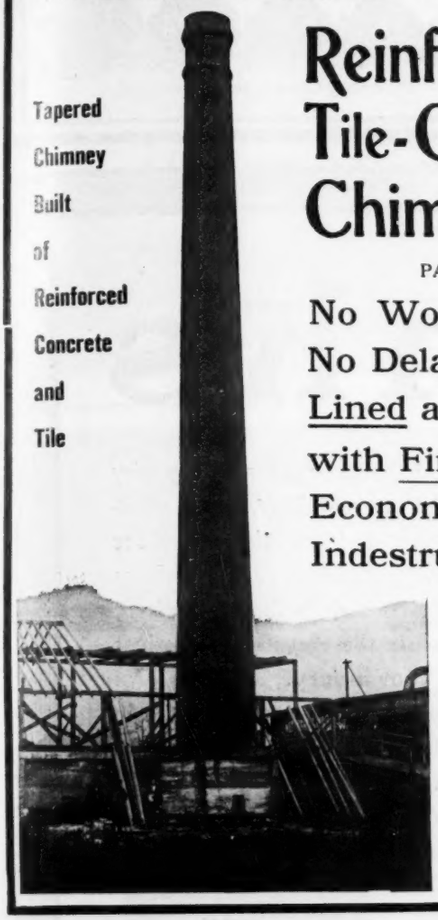

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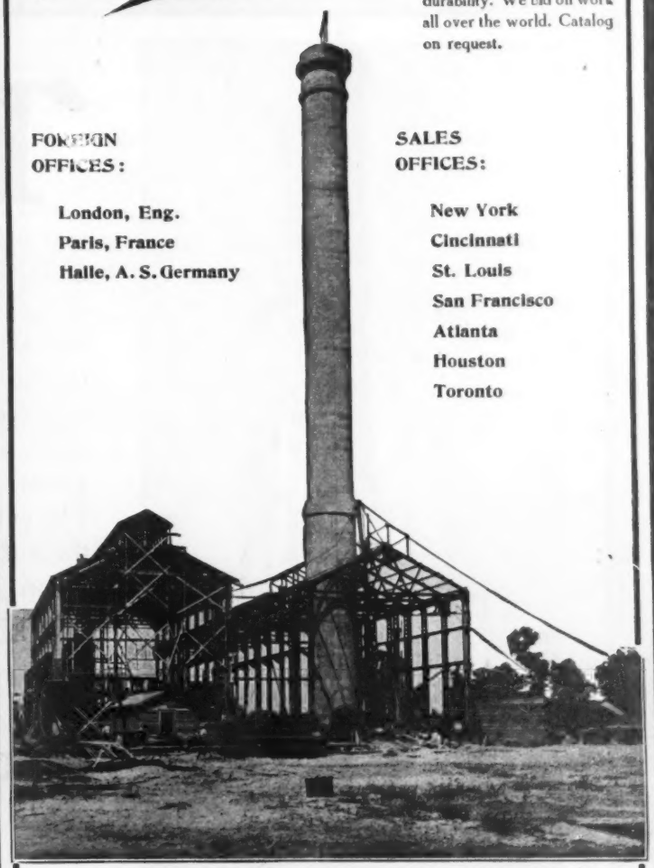

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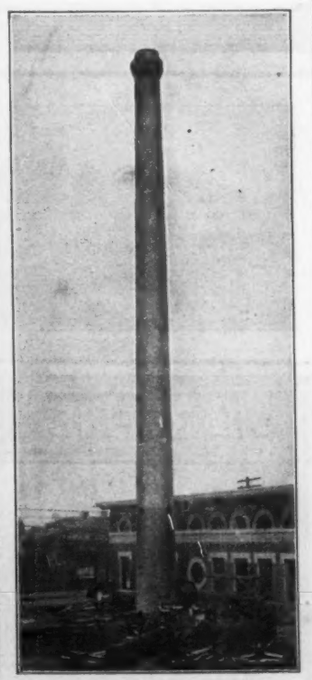

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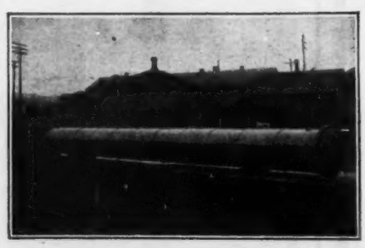

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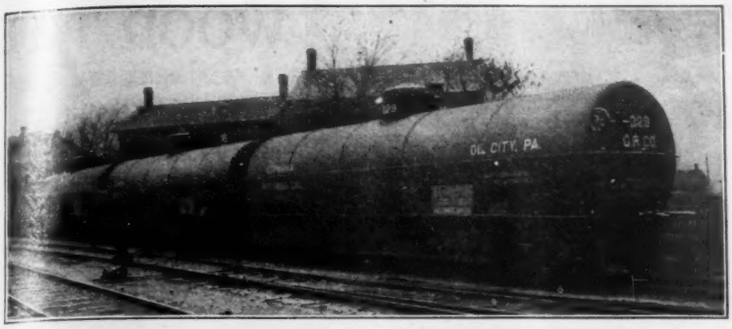

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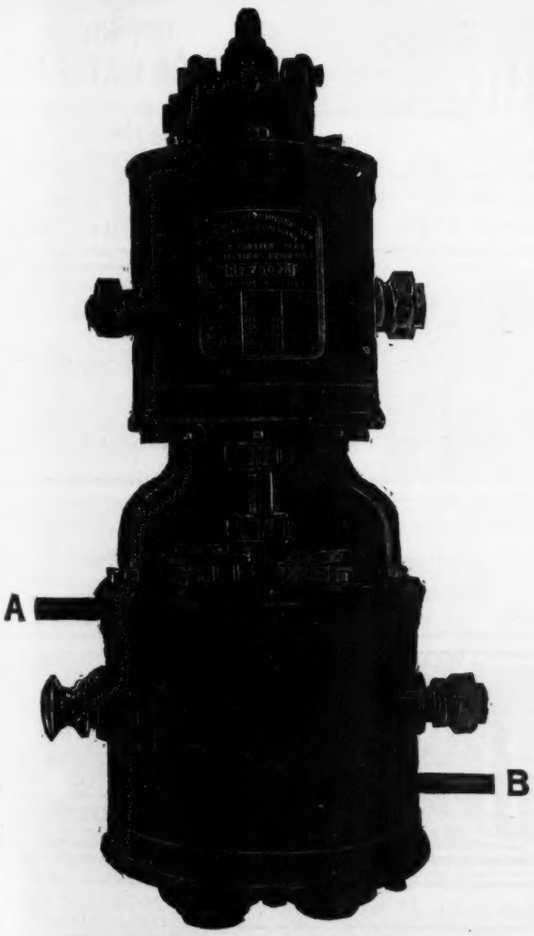

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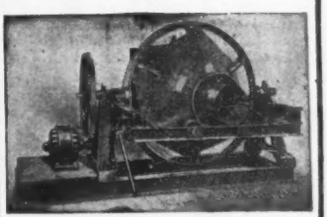

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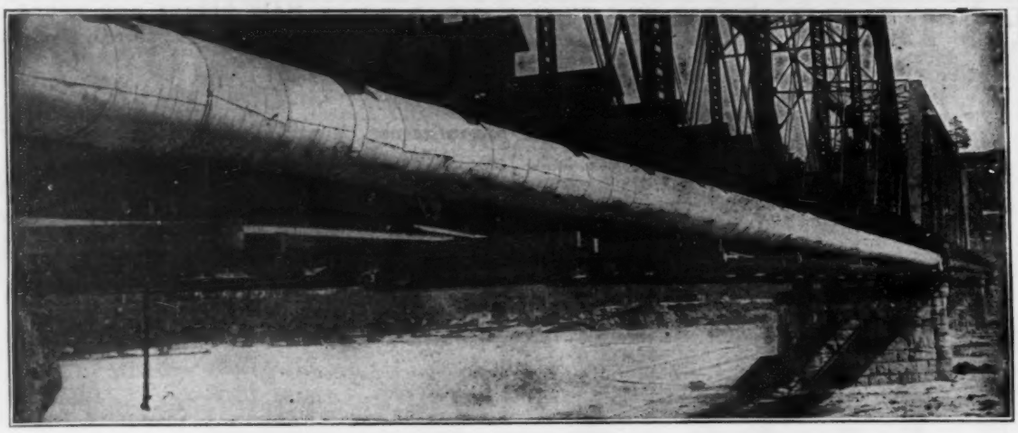

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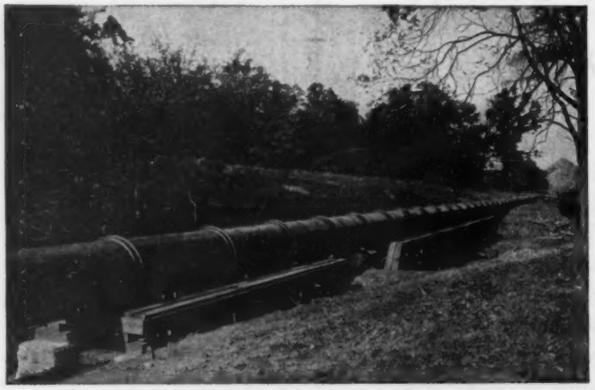

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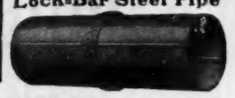

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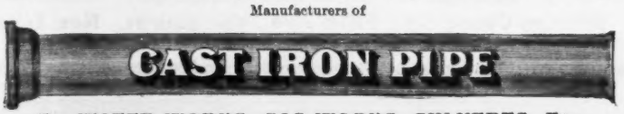

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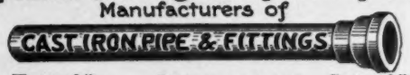

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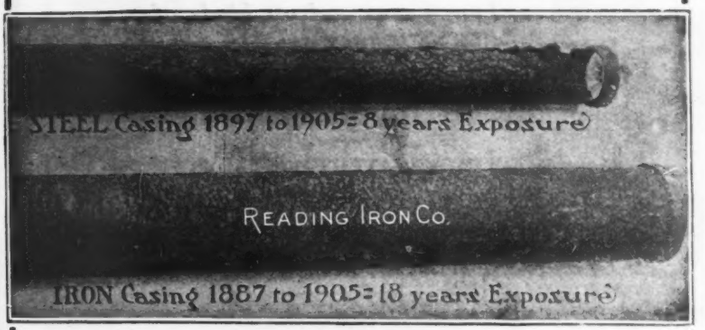

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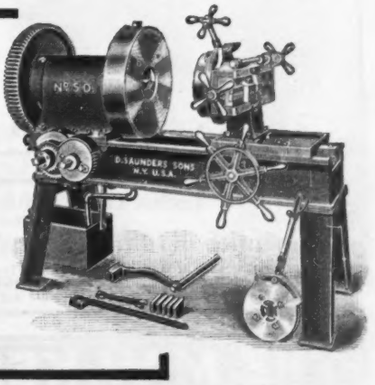

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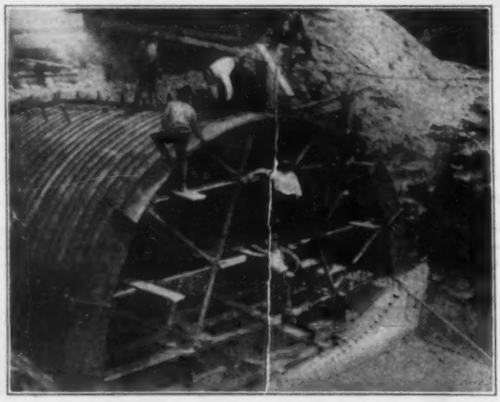

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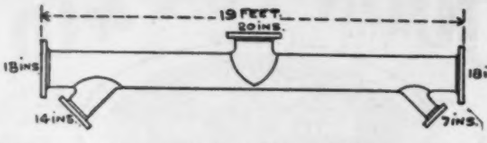

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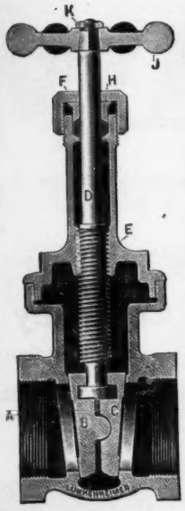

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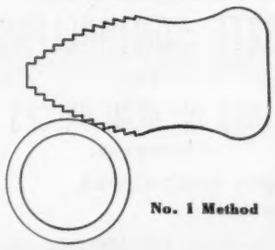

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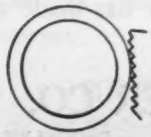

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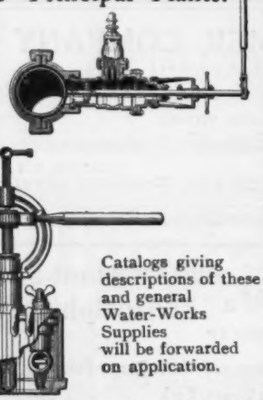

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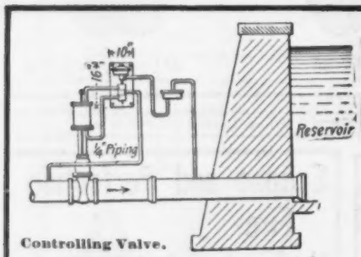

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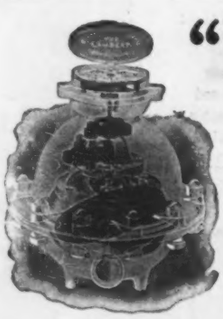

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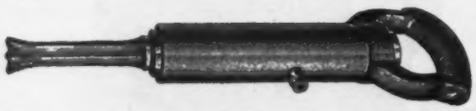

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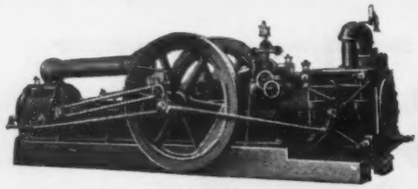

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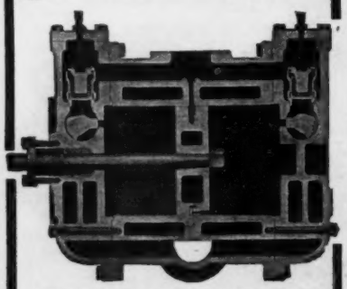

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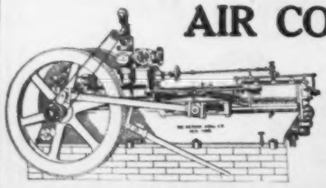

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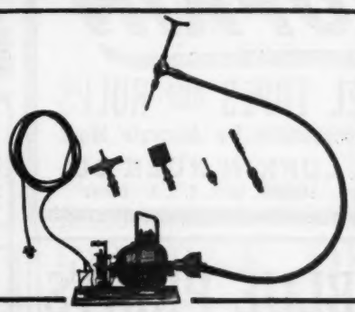

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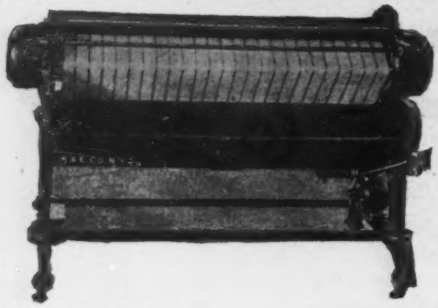

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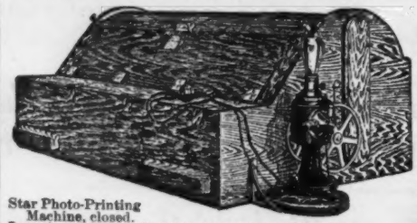

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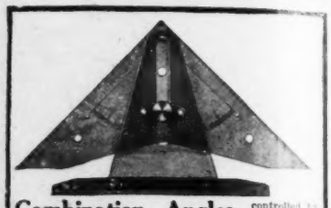

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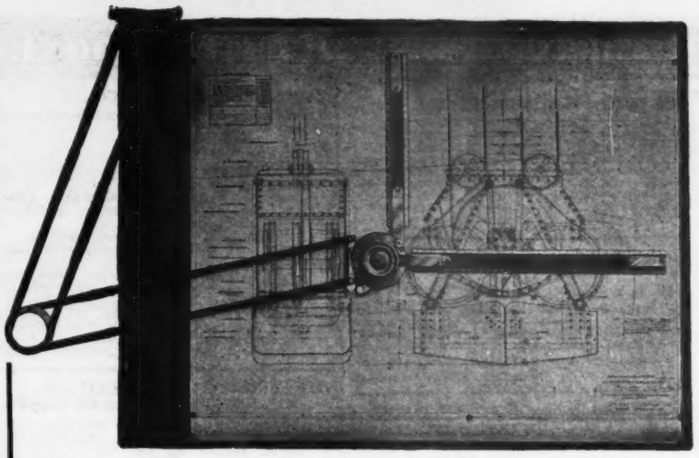

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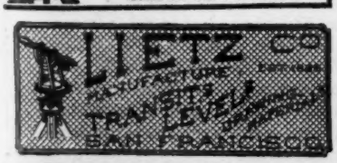

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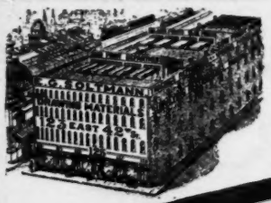

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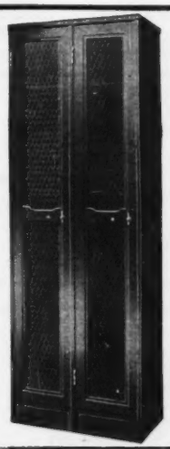

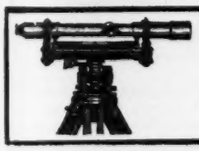

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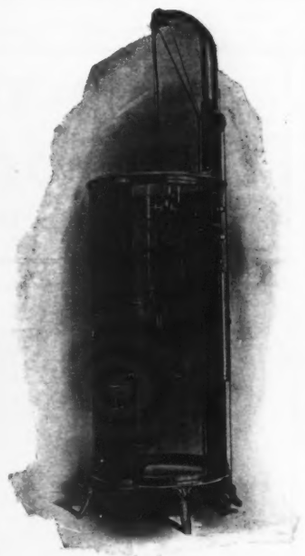

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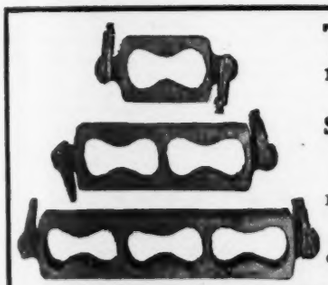

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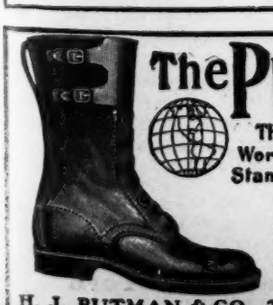

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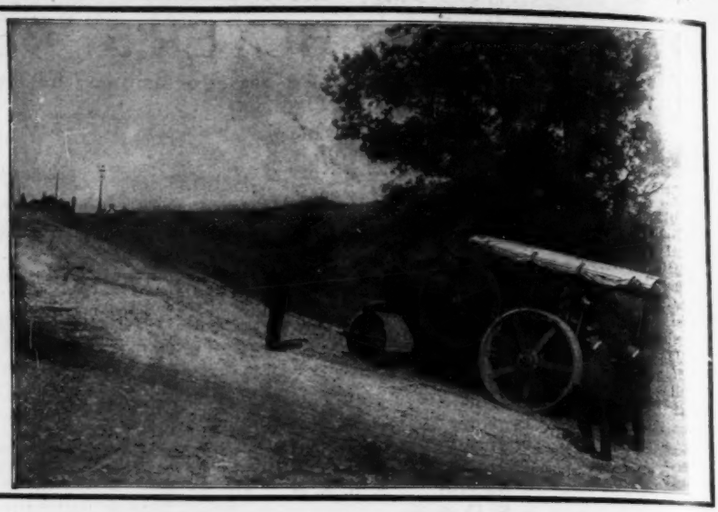

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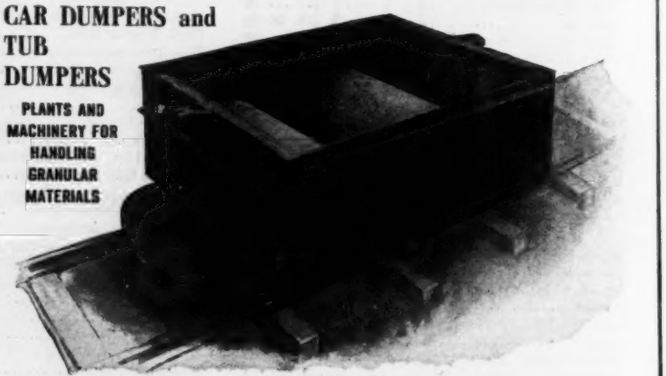

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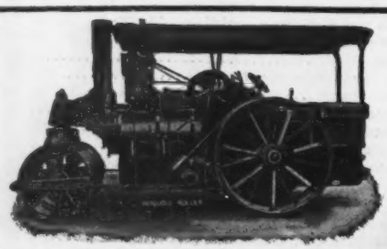

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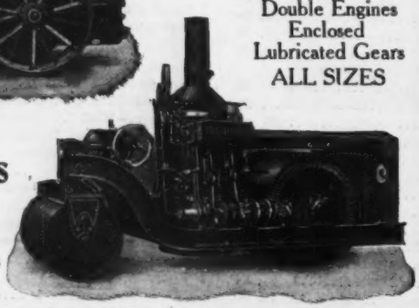

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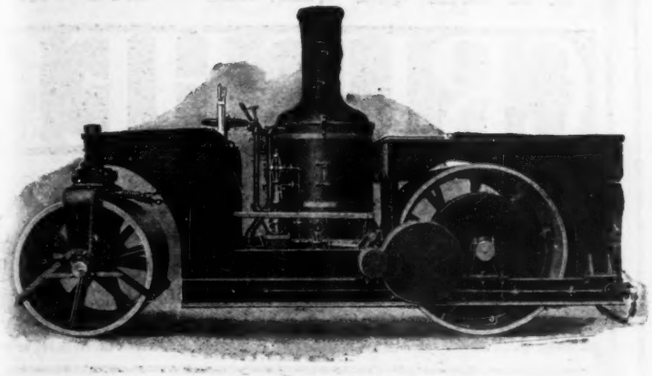

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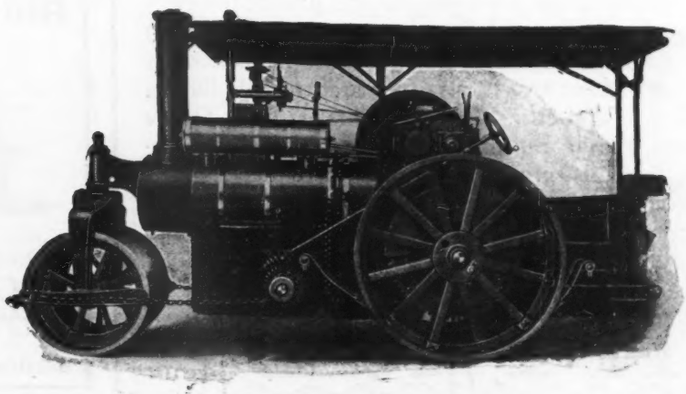

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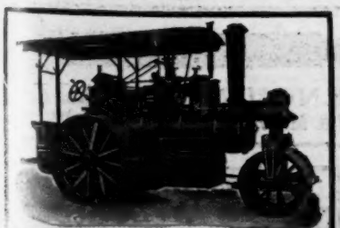

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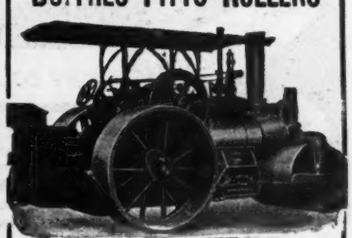

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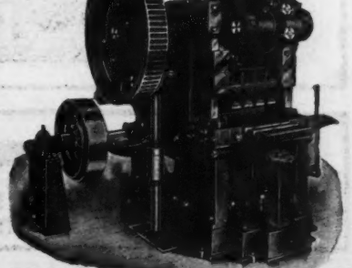

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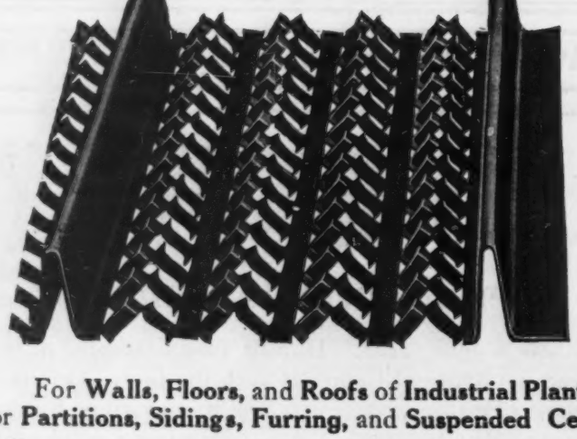

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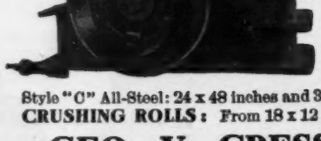

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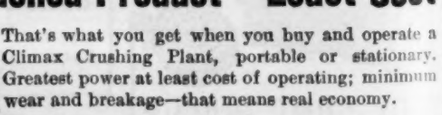

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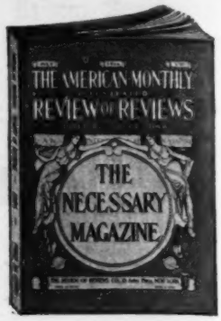

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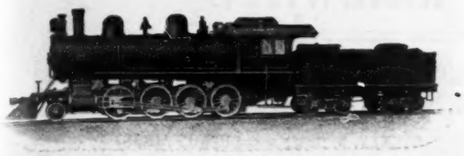

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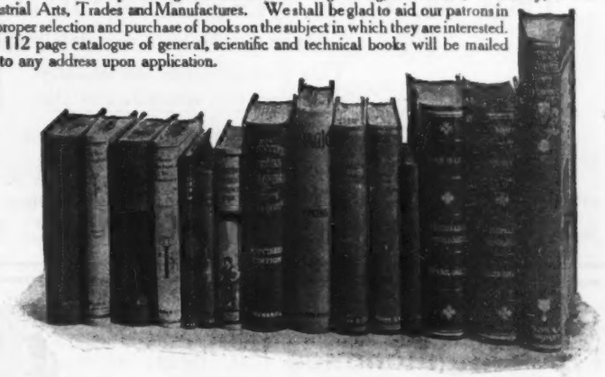

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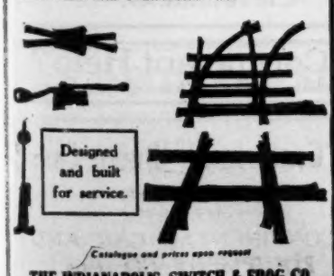

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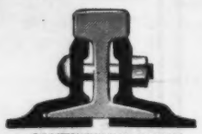

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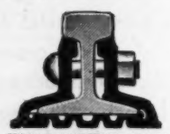

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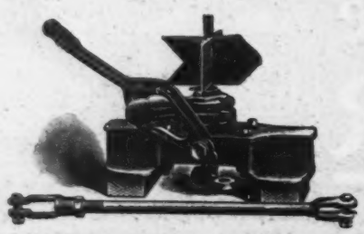

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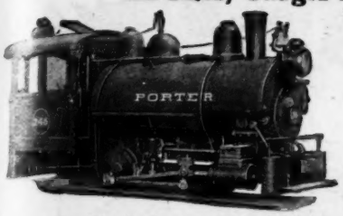

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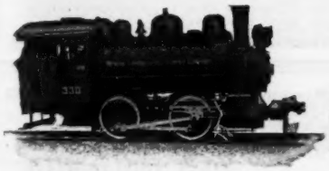

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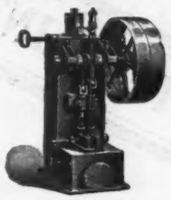

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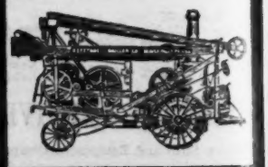

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THE CITY OF PROVIDENCE.

Department of Public Works, Commissioner's Office, City Hall, Providence, R. I., December 29, 1908.

Sealed proposals will be received at this office until 11 o'clock A. M., Friday, January 8th, 1909, for furnishing the following sizes of

CAST IRON WATER PIPES:

618 tons of 2,000 lbs.. 16 ins. in diameter;
300 tons of 2,000 lbs., 12 ins. in diameter;
60 tons of 2,000 lbs., 8 ins. in diameter;
346 tons of 2,000 lbs., 6 ins. in diameter;
10 tons of 2,000 lbs., 4 ins. in diameter.

The delivery to commence on or before March 15, 1909, and to continue as rapidly as required and to be fully completed on or before June 1, 1909.

A bond satisfactory to the Commissioner, or a certified check in the sum of $1,500.00 as liquidated damages for failure to execute the contract within ten days, if awarded, will be required of each bidder, and a satisfactory bond in the sum of $6,300.00 conditioned upon the faithful fulfilment of the contract will be required of the successful bidder.

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GRADING, CURBING, PAVING AND SEWERING.

The Board of Affairs of the City of Charleston, West Virginia, will, until 2:30 P. M. on Wednesday, the 6th day of January, 1909, receive sealed bids for grading, curbing, paving and sewering certain portions of the streets and alleys of the City of Charleston.

The amount of work embraced in street paving approximates $210,000 and in sewer work $30,000. Bids will be received separately for street paving or sewer work.

Each bid on paving must be accompanied with a certified check in the sum of $7,000 and each bid on sewer work in the sum of $1,200, drawn upon some known, responsible bank in the City of Charleston, W. Va., payable to the order of J. F. Bedell, City Treasurer.

The right is reserved to reject any and all bids and to let the work as a whole or in part.

For further information call on or address.

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CHAS. L. COVELL, Supt.

FORT MONROE, VA., December 2, 1908.—Sealed proposals, in triplicate, will be received until 10 A. M., January 4, 1909, for furnishing and installing two 264-HP., and one 100-HP. boilers, two 250-HP. compound engines, one 250-HP. and one 120-HP. engines, two 150-KW. and one 75-KW. generators; also all steam, exhaust steam, drip and water, suction and discharge connections; one service condenser and gage board, two boiler feed pumps, three composite inspirators, one feed-water heater, one hot well and automatic pump for oil separator. Also for furnishing and installing complete underground system and complete system of street lighting at Fort Monroe, Va. Bids for five different kinds of work must be submitted separately; bidders on proposals must state names of manufacturers supplying material. Information on application. United States reserves the right to accept or reject any or all proposals or any part thereof. ERNEST R. TILTON, Captain & Constructing Q. M.

DEPARTMENT OF THE INTERIOR, United States Reclamation Service, Washington, D. C.—Sealed proposals will be received at the office of the United States Reclamation Service, 417 Beck Building, Portland, Oregon, until 10 o'clock a. m., January 15, 1909, for furnishing 25,000 barrels of Portland cement, f. o. b. cars at the works of the bidder. For particulars address the U. S. Reclamation Service, Washington, D. C., or Portland, Oregon. JAMES RUDOLPH GARFIELD, Secretary.

AQUEDUCT.

New York, N. Y.

Sealed bids or proposals will be received by the Board of Water Supply, in the office of the Board, 299 Broadway, New York, Room 910, ninth floor, until 11 A. M., on January 7, 1909, for CONTRACT 36 for the construction of the NORTH HALF OF THE WALLKILL PRESSURE TUNNEL, a tunnel in rock crossing under the valley of the Wallkill river, with three shafts 350 to 480 feet in depth, and a short stretch of plain concrete conduit, known as cut-and-cover aqueduct; and for CONTRACT 37 for the construction of the SOUTH HALF OF THE WALLKILL PRESSURE TUNNEL, with three shafts 350 to 400 feet in depth, and a short stretch of plain concrete conduit, known as cut-and-cover aqueduct. The pressure tunnel will be circular, 14½ feet inside diameter, and the aqueduct, 17 feet high by 17½ feet wide inside. The work is located in the towns of New Paltz and Gardiner, Ulster County, New York.

BIDS OR PROPOSALS ARE INVITED FOR EACH CONTRACT SEPARATELY AND FOR BOTH CONTRACTS COMBINED. Any bidder may make a bid for either contract or for the two contracts combined. A separate form of proposal will be furnished for the purpose of the combined bid.

An approximate statement of the quantities of the various classes of work and further information are given in the Information for Bidders, forming part of the contract. At the above place and time the bids will be publicly opened and read. The award of the contract, if awarded, will be made by the Board as soon thereafter as practicable.

The Board may reject any or all bids.

Two or more bonds, the aggregate amount of which shall be four hundred and fifty thousand dollars ($450,000) under each contract, will be required for the faithful performance of the contract. No bid will be received and deposited unless accompanied by a certified check upon a National or State bank, drawn to the order of the Comptroller of the City of New York to the amount of fifty thousand dollers ($50,000) for each contract. Only one check for each contract will be required whether bids are submitted for the contracts separately or combined.

Time allowed for the completion of the work under each contract is 42 months from the service of notice by the Board to begin work.

Pamphlets containing information for bidders, form of contract, specifications, etc., and pamphlets of contract drawings, can be obtained at Room 1515 at the above address, by depositing the sum of ten dollars ($10) for each pamphlet, or twenty dollars ($20) for each set, to insure their return in acceptable condition within thirty days from the date upon which bids are to be opened.

JOHN A. BENSEL,
President;
CHARLES N. CHADWICK,
CHARLES A. SHAW,
Commissioners of the Board of Water Supply.
J. WALDO SMITH,
Chief Engineer.
THOMAS HASSETT,
Secretary.

SEALED PROPOSALS will be received at the office of the Light-House Engineer, Mobile, Ala., until 12 o'clock M., Jan. 4, 1909, and then opened, for furnishing materials and labor of all kinds necessary for the construction and delivery of the metal work for Galveston Jetty Light-Station, Texas, in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to the LIGHT-HOUSE ENGINEER, Mobile, Ala.

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up to 12 o'clock noon of the 16th day of January, A. D. 1909, proposals to be addressed to L. G. Aymard, Clerk of the Board of Public Works, and endorsed "Proposals for Construction of Concrete Sidewalks."

The work contemplated consists of approximately 634,000 square feet of concrete sidewalks. Specifications and blank form of proposal and contract can be obtained from the office of the City Engineer, Room No. 208, City Hall.

The right is reserved to reject any and all bids.

Each proposal to be accompanied by a certified check for $500.00, payable to the City of Pensacola.

LEE DANIELL,
Chairman Board of Public Works.
L. EARLE THORNTON,
City Engineer.

CONSTRUCTING QUARTERMASTER'S OFFICE, FORT MEADE, S. D., December 12th, 1908.—Sealed proposals, in triplicate, will be received at this office until 10 A. M., Mountain Time, January 18th, 1909, and then opened, for constructing one Hay Shed. Plans and specifications may be seen by intending bidders at the offices of the Chief Quartermaster, Department of the Missouri, Omaha, Nebraska; Department of the Colorado, Denver, Colo.; Department of the Lakes, Chicago, Ill.; Department of Dakota, St. Paul, Minn., and this office, at which latter place all information may be obtained upon application. A deposit of $10.00, to insure return, is required before plans are sent on individual application. The United States reserves the right to reject any or all bids or to accept any part of a bid that may be advantageous to the Government. Envelopes containing proposals should be endorsed "Proposals for Hay Shed, Fort Meade, S. D.," and addressed to L. C. SCHERER, Captain and Q. M., 4th Cavalry, Constructing Quartermaster.

[illegible] office of the Engineer, C. M. Rogers, Daytona, Florida, or the Engineering News, 220 Broadway, New York City.

The right is reserved by the Board to reject any or all bids should it be deemed for the best interests of the City so to do.

C. M. ROGERS,
Engineer of the Board of Public Works.

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 24, 1908.—Sealed proposals will be received at this office until 3 o'clock P. M. on the 4th day of February, 1909, and then opened, for the construction (complete) of the extension to the U. S. Post Office and Court House at San Antonio, Texas, in accordance with the drawings and specification, copies of which may be had at this office, or at the office of the Custodian at San Antonio, Texas, at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 21, 1908.—Sealed proposals will be received at this office until 3 o'clock P. M., on the 1st day of February, 1909, and then opened, for the construction (complete) of the U. S. Postoffice at Fayetteville, Ark., in strict accordance with the drawings and specification, copies of which may be had at this office or at the office of the Postmaster at Fayetteville, Ark., at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

U. S. ENGINEER OFFICE, New London, Conn., Dec. 23, 1908.—Sealed proposals for dredging in Bridgeport Harbor, Conn., will be received here until 12 o'clock noon, Jan. 23, 1909, and then publicly opened. Information on application. HARRY TAYLOR, Maj. Engrs.

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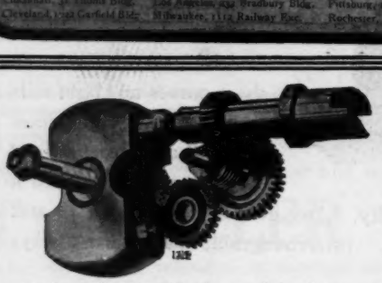

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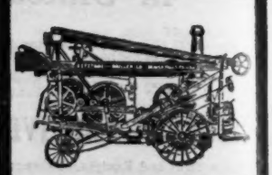

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Formerly The Pittsburgh Reduction Co.

TO IRON FOUNDERS.

THE CITY OF PROVIDENCE.

Department of Public Works, Commissioner's Office, City Hall, Providence, R. I., December 29, 1908.

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The right to reject any or all proposals is reserved.

WALTER F. SLADE,
Commissioner.

FURNISHINGS.

Wilkes-Barre, Pa.

Sealed proposals will be received by James M. Norris, County Controller, at the Controller's office in Wilkes-Barre, Pa., until 2 p. m., Thursday, Jan. 14, 1909, for furnishing floor coverings, draperies and shades for the Luzerne County New Court House, according to plans and specifications on file in the Commissioners' office, prepared by McCormick & French, architects, and which may be had at cost upon application at their office in Wilkes-Barre, Pa.

Each proposal must be accompanied by a certified check for $5,000 and must state how soon the work will be fully completed and installed.

The right to reject any or all bids is reserved.

JAMES M. NORRIS,
Controller.

JAMES A. DEWEY,
Deputy Controller.

Wilkes-Barre, Pa.. Dec. 23, 1908.

CONCRETE SIDEWALKS.

Pensacola, Fla.

Sealed proposals for the construction of concrete sidewalks in the City of Pensacola, Florida, will be received by the Board of Public Works at the City Hall up to 12 o'clock noon of the 18th day of January, A. D. 1909, proposals to be addressed to L. G. Aymard, Clerk of the Board of Public Works, and endorsed "Proposals for Construction of Concrete Sidewalks."

The work contemplated consists of approximately 634,000 square feet of concrete sidewalks. Specifications and blank form of proposal and contract can be obtained from the office of the City Engineer, Room No. 203, City Hall.

The right is reserved to reject any and all bids.

Each proposal to be accompanied by a certified check for $500.00, payable to the City of Pensacola.

LEE DANIELL,
Chairman Board of Public Works.
L. EARLE THORNTON,
City Engineer.

CONSTRUCTING QUARTERMASTER'S OFFICE, FORT MEADE, S. D., December 12th, 1908.—Sealed proposals, in triplicate, will be received at this office until 10 A. M., Mountain Time, January 18th, 1909, and then opened, for constructing one Hay Shed. Plans and specifications may be seen by intending bidders at the offices of the Chief Quartermaster, Department of the Missouri, Omaha, Nebraska; Department of the Colorado, Denver, Colo.; Department of the Lakes, Chicago, Ill.; Department of Dakota, St. Paul, Minn., and this office, at which latter place all information may be obtained upon application. A deposit of $10.00, to insure return, is required before plans are sent on individual application. The United States reserves the right to reject any or all bids or to accept any part of a bid that may be advantageous to the Government. Envelopes containing proposals should be endorsed "Proposals for Hay Shed, Fort Meade, S. D.," and addressed to L. C. SCHERER, Captain and Q. M., 4th Cavalry, Constructing Quartermaster.

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WATER-WORKS.

Sealed proposals will be received by the Board of Public Works of the City of Daytona, Florida, at the City Hall of said city up to three o'clock P. M. of the twenty-fifth (25) day of January, 1909, for furnishing materials and constructing a system of Water-Works for said City.

There will be required approximately the following:

1,000 tons cast-iron pipe.
16 tons of special castings.
76 two way fire hydrants.
10 10-inch gate valves.
20 8-inch gate valves.
60 6-inch gate valves.
3 8-inch check valves.
1 pressure release valve.
Gasoline engine and power pump, 1,100,000 gallons capacity, with 100 lbs. pressure.
Elevated steel tank and steel tower.
7 four-inch artesian wells.
Concrete foundations, pumping plant building and concrete receiving well.
Installing system.

Bids will be received for furnishing any of the above materials and work, or for constructing the works complete. A certified check equal to 5 per cent. of the amount of the bid, must accompany each bid. Checks to be made payable to the Chairman of the Board of Public Works of the City of Daytona, Florida.

Plans may be seen and specification blank forms of proposals procured at the office of the Engineer, C. M. Rogers, Daytona, Florida, or the Engineering News, 220 Broadway, New York City.

The right is reserved by the Board to reject any or all bids should it be deemed for the best interests of the City so to do.

C. M. ROGERS,
Engineer of the Board of Public Works.

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 24, 1908.—Sealed proposals will be received at this office until 3 o'clock P. M. on the 4th day of February, 1909, and then opened, for the construction (complete) of the extension to the U. S. Post Office and Court House at San Antonio, Texas, in accordance with the drawings and specification, copies of which may be had at this office, or at the office of the Custodian at San Antonio, Texas, at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., December 21, 1908.—Sealed proposals will be received at this office until 3 o'clock P. M., on the 1st day of February, 1909, and then opened, for the construction (complete) of the U. S. Postoffice at Fayetteville, Ark., in strict accordance with the drawings and specification, copies of which may be had at this office or at the office of the Postmaster at Fayetteville, Ark., at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

U. S. ENGINEER OFFICE, New London, Conn., Dec. 23, 1908.—Sealed proposals for dredging in Bridgeport Harbor, Conn., will be received here until 12 o'clock noon, Jan. 23, 1909, and then publicly opened. Information on application. HARRY TAYLOR, Maj. Engrs.

A postal will bring gratis DATA on **SHOVELS**

THE WYOMING SHOVEL WORKS, Wyoming, Pa.

GRADING, CURBING, PAVING AND SEWERING.

The Board of Affairs of the City of Charleston, West Virginia, will, until 2:30 P. M. on Wednesday, the 6th day of January, 1909, receive sealed bids for grading, curbing, paving and sewering certain portions of the streets and alleys of the City of Charleston.

The amount of work embraced in street paving approximates $210,000 and in sewer work $30,000. Bids will be received separately for street paving or sewer work.

Each bid on paving must be accompanied with a certified check in the sum of $7,000 and each bid on sewer work in the sum of $1,200, drawn upon some known, responsible bank in the City of Charleston, W. Va., payable to the order of J. F. Bedell, City Treasurer.

The right is reserved to reject any and all bids and to let the work as a whole or in part.

For further information call on or address.

W. A. HOGUE,
City Engineer.
Charleston, Kanawha County, W. Va.

TANK.

Wellington, Kan.

The City of Wellington will erect one water tank 140 ft. in height and of a capacity of 150,000 gals. Bids received on 18th of January.

CHAS. L. COVELL, Supt.

FORT MONROE, VA., December 2, 1908.—Sealed proposals, in triplicate, will be received until 10 A. M., January 4, 1908, for furnishing and installing two 264-HP., and one 100-HP. boilers, two 250-HP. compound engines, one 250-HP. and one 120-HP. engines, two 150-KW. and one 75-KW. generators; also all steam, exhaust steam, drip and water, suction and discharge connections; one service condenser and gage board, two boiler feed pumps, three composite inspirators, one feed-water heater, one hot well and automatic pump for oil separator. Also for furnishing and installing complete underground system and complete system of street lighting at Fort Monroe, Va. Bids for five different kinds of work must be submitted separately; bidders on proposals must state names of manufacturers supplying material. Information on application. United States reserves the right to accept or reject any or all proposals or any part thereof. ERNEST R. TILTON, Captain & Constructing Q. M.

DEPARTMENT OF THE INTERIOR, United States Reclamation Service, Washington, D. C.—Sealed proposals will be received at the office of the United States Reclamation Service, 417 Beck Building, Portland, Oregon, until 10 o'clock a. m., January 15, 1909, for furnishing 25,000 barrels of Portland cement, f. o. b. cars at the works of the bidder. For particulars address the U. S. Reclamation Service, Washington, D. C., or Portland, Oregon. JAMES RUDOLPH GARFIELD, Secretary.

AQUEDUCT.

New York, N. Y.

Sealed bids or proposals will be received by the Board of Water Supply, in the office of the Board, 299 Broadway, New York, Room 910, ninth floor, until 11 A. M., on January 7, 1909, for CONTRACT 36 for the construction of the NORTH HALF OF THE WALLKILL PRESSURE TUNNEL, a tunnel in rock crossing under the valley of the Wallkill river, with three shafts 350 to 480 feet in depth, and a short stretch of plain concrete conduit, known as cut-and-cover aqueduct; and for CONTRACT 37 for the construction of the SOUTH HALF OF THE WALLKILL PRESSURE TUNNEL, with three shafts 350 to 400 feet in depth, and a short stretch of plain concrete conduit, known as cut-and-cover aqueduct. The pressure tunnel will be circular, 14½ feet inside diameter, and the aqueduct, 17 feet high by 17½ feet wide inside. The work is located in the towns of New Paltz and Gardiner, Ulster County, New York.

BIDS OR PROPOSALS ARE INVITED FOR EACH CONTRACT SEPARATELY AND FOR BOTH CONTRACTS COMBINED. Any bidder may make a bid for either contract or for the two contracts combined. A separate form of proposal will be furnished for the purpose of the combined bid.

An approximate statement of the quantities of the various classes of work and further information are given in the Information for Bidders, forming part of the contract. At the above place and time the bids will be publicly opened and read. The award of the contract, if awarded, will be made by the Board as soon thereafter as practicable.

The Board may reject any or all bids.

Two or more bonds, the aggregate amount of which shall be four hundred and fifty thousand dollars ($450,000) under each contract, will be required for the faithful performance of the contract. No bid will be received and deposited unless accompanied by a certified check upon a National or State bank, drawn to the order of the Comptroller of the City of New York to the amount of fifty thousand dollers ($50,000) for each contract. Only one check for each contract will be required whether bids are submitted for the contracts separately or combined.

Time allowed for the completion of the work under each contract is 42 months from the service of notice by the Board to begin work.

Pamphlets containing information for bidders, form of contract, specifications, etc., and pamphlets of contract drawings, can be obtained at Room 1515 at the above address, by depositing the sum of ten dollars ($10) for each pamphlet, or twenty dollars ($20) for each set, to insure their return in acceptable condition within thirty days from the date upon which bids are to be opened.

JOHN A. BENSEL,
President;
CHARLES N. CHADWICK,
CHARLES A. SHAW,
Commissioners of the Board of Water Supply.
J. WALDO SMITH,
Chief Engineer.
THOMAS HASSETT,
Secretary.

SEALED PROPOSALS will be received at the office of the Light-House Engineer, Mobile, Ala., until 12 o'clock M., Jan. 4, 1909, and then opened, for furnishing materials and labor of all kinds necessary for the construction and delivery of the metal work for Galveston Jetty Light-Station, Texas, in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to the LIGHT-HOUSE ENGINEER, Mobile, Ala.

For other
PROPOSAL ADVERTISEMENTS
See Pages 47, 48, 50 and Construction News, page 236.

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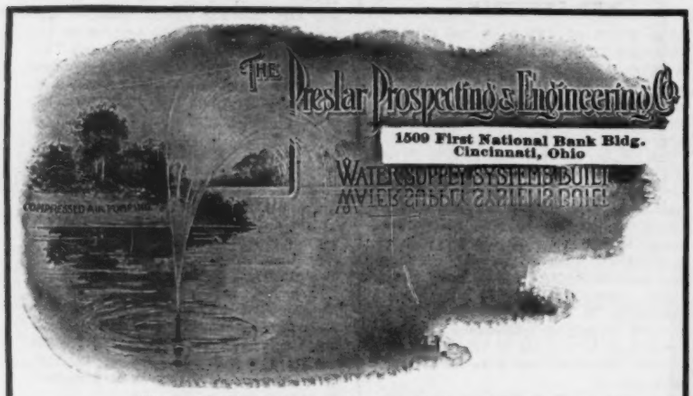
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STEEL BRIDGE.

Augusta, Ga.

Sealed proposals, addressed to the River, Bridges and Wharves Committee, of the City Council of Augusta, Ga., will be received until 12 o'clock noon, Tuesday, January 12th, 1909, for furnishing all labor and material and constructing complete, except piers, a steel bridge with draw span over the Savannah River, at Augusta, Georgia, at the extension of Fifth (Center) Street. There will be eight (8) spans of a total length of nine hundred and twenty-eight (928).

Cash, or a certified check for Five Hundred ($500.00) Dollars, will be required as a guarantee of good faith.

The successful bidder will be required to give a bond of Ten Thousand ($10,000.00) Dollars.

The City reserves the right to reject any or all bids.

For further information apply to the undersigned.

NISBET WINGFIELD,
City Engineer, Augusta, Ga.

PROPOSALS FOR CONSTRUCTION OF BARRACKS AND QUARTERS, AND PLUMBING, HEATING AND ELECTRIC WIRING SAME.—War Department, Office of the Constructing Quartermaster, New London, Conn., November 28, 1908.—Sealed proposals for constructing one double barracks, one single barrack, two Field Officers' quarters, one four-set officers' quarters, two Lieutenants' quarters, three double Non-commissioned Officers' quarters, and one double Firemen's quarters, at Fort Terry (Plum Island), New York, and two double barracks, two Field Officers' quarters, four Lieutenants' quarters, two double Non-commissioned Officers' quarters, and two double Firemen's quarters, at Fort H. G. Wright (Fishers Island), New York, and for plumbing, electric wiring, and installing heating plants in same, will be received here until 10:00 A. M., February 10, 1909, and then opened. Proposals are desired for brick construction of all buildings and for reinforced-concrete construction, on bidders' plans, of barracks and Non-commissioned Officers' and Firemen's quarters. Information furnished on application. Envelopes containing proposals should be endorsed: "Proposals for Public Buildings," and addressed, "R. M. Schofield, Major, Q. M., Constructing Quartermaster, New London, Conn."

U. S. ENGINEER OFFICE, Mobile, Ala.—Sealed proposals for dredging in harbor at Mobile, Ala., will be received at this office until 11 A. M., January 15, 1909, and then publicly opened. Information on application. H. JERVEY, Major, Engineers.

For other PROPOSAL ADVERTISEMENTS See Pages 47, 48, 50 and Construction News, page 236.

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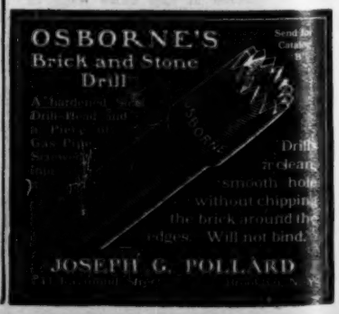

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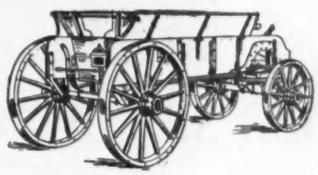

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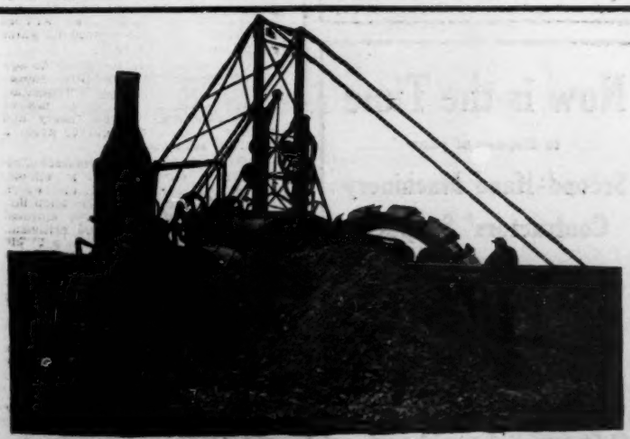

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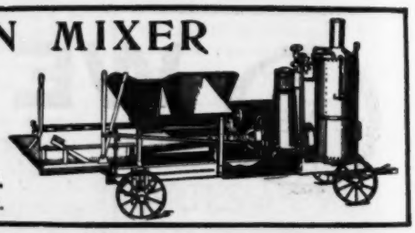

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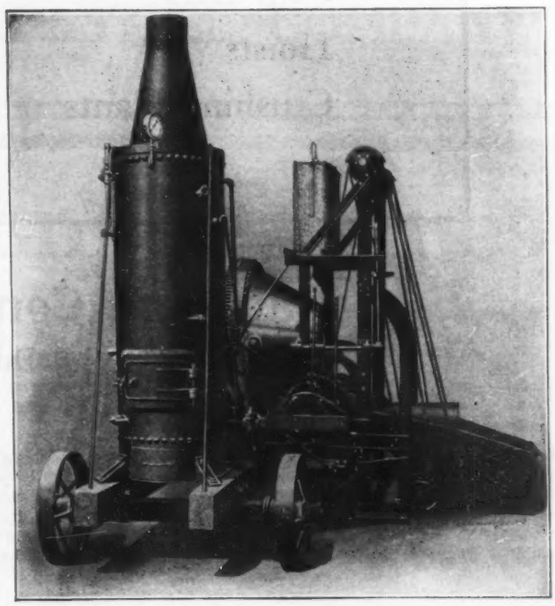

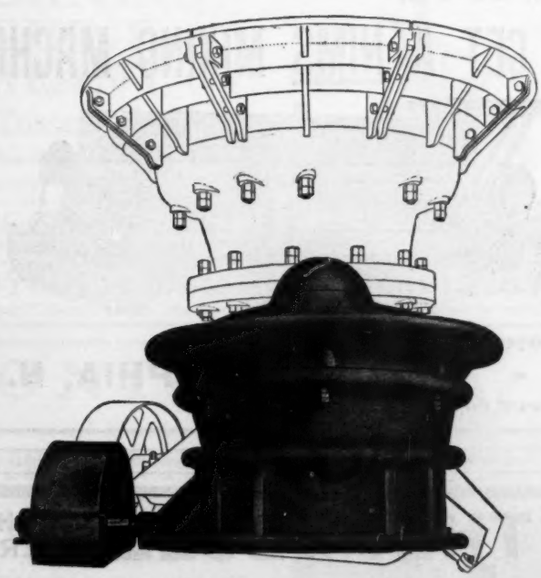

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Mixers Concrete Carts Wheelbarrows
Skip Cars Quick Unloading Car Chutes
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DO you wish to mix concrete and do it right all the time?
you understand the value of giving concrete materials a dry mix first?
you want to know how many yards are turned out every hour or day?

THEN GET A NIMS MIXING MACHINE

HONEST WORK AND SATISFACTORY RESULTS

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THE FORCE FEED DOES IT

That's what makes

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ACCURATE DEPENDABLE

The force feed is different than a worm feed. It's more reliable, because it always feeds the same amount. Proportions cannot vary. When you change proportions you do so instantly, because there are no sprockets or chains to adjust. THINK OF THE SAVING IN TIME. The revolving drum insures an even, thorough mix. No paddles to wear and break. If you want a machine that's different from others and BETTER write for information today.

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The name "Hadsel" as applied to concrete mixers is synonymous with perfect mixtures, maximum results and minimum cost of maintenance. The Hadsel Mixers are built by an organization whose members have been in the concrete business for years. The Hadsel Mixer is the result of a complete knowledge of concrete engineering, combined with practical experience in successful concrete contracting.

"The Mixer That Mixes"

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"See the Point"

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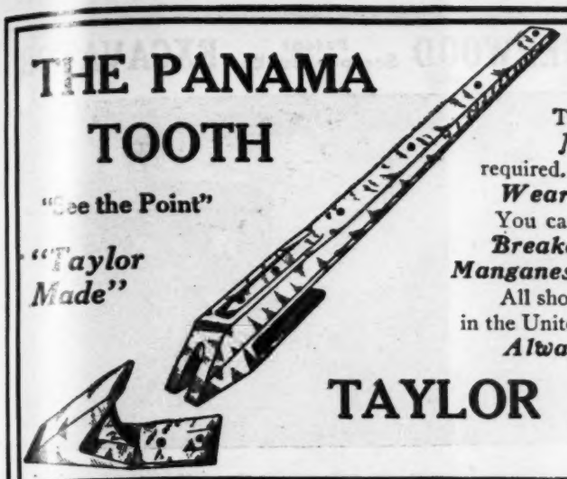

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The ***Web*** cast in the point prevents the flanges from spreading.

No Rivets necessary to hold the point in place; only one or two bolts required.

Wears from three to five times as long as a forged tool steel point.

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Always sharp, because it is designed scientifically.

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Double Drum Spur-Geared Engine and Boiler, with Double Horizontal Engines and Patent Friction Drums.

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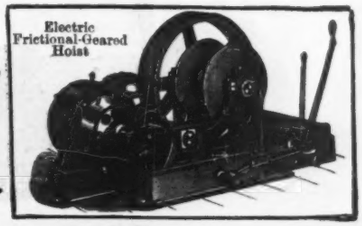

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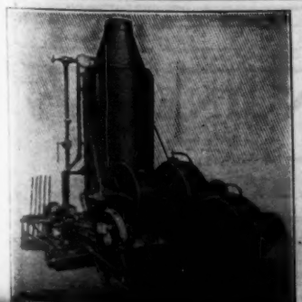

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A FIVE YEARS' TEST OF

FOOTE MIXERS

TEXAS BITULITHIC COMPANY

BITULITHIC PAVEMENT

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Gentlemen:

The Foote Continuous Mixer, No. 3, steam power with traction ordered by us a month ago has arrived at Ft. Worth, and we will begin working it there within a few days.

We have been using your continuous mixers for street work during the past five years and we have found them more rapid and economical than any other mixer we could get. Our experience with these machines during the past five years shows that by their use we can save about $20 per day over hand labor.

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For { Mining, Quarrying, Coal Handling, Pile Driving, Builders' Use, Logging and General Contracting

Cableways, Electric Hoists

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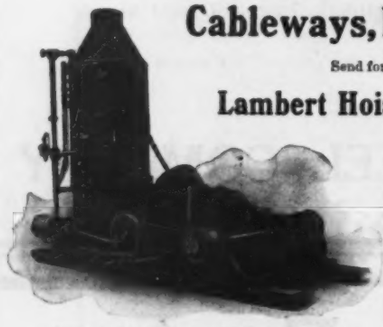

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Mounted on roller bearing turntables. Can make complete revolutions. Digs and deposits the load at any point within the circle. Reaches at one operation from the bottom of the excavation to the top of the spoil bank. Operates equally well with orange peel, clam shell or scraper buckets. Three sizes. Swing booms up to 90 feet long with 1½-yard scraper or 80 feet with 2-yard scraper.

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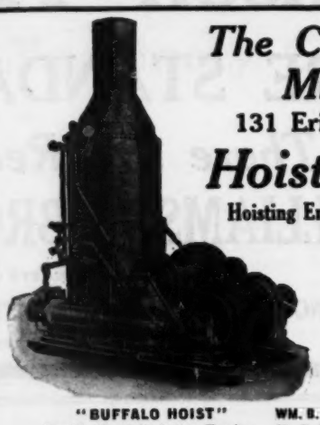

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Hoisting Engines **Electric Hoists**
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Derricks—Wood, Steel and Pipe
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Have Large Stock on Hand
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Double Drum Hoisting Engine

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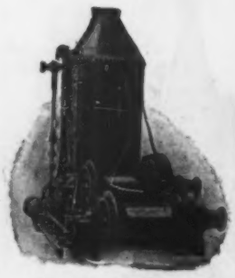

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Adapted for Contractors, Mines, Quarries, etc.

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All our engines are thoroughly tested with steam before leaving our works, thus insuring their being in perfect condition upon delivery. This also applies to our boilers.

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DREDGES, DITCHERS, DERRICKS
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We do not manufacture for export

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Steam-operated

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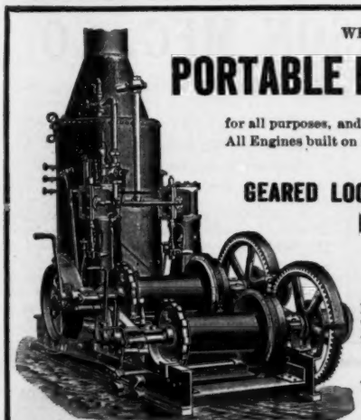
for all purposes, and sell them at the lowest possible price.
All Engines built on Steel Frame and with Steel Drum Barrels.

ALSO

GEARED LOCOMOTIVES, DERRICK CARS, DERRICK IRONS, HAND POWERS BLOCKS AND SHEAVES



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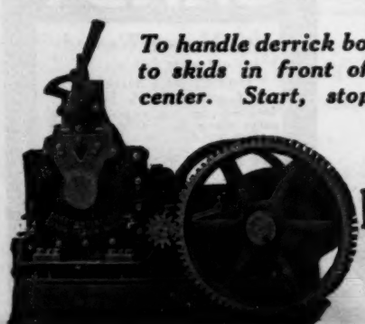

To handle derrick booms. Can be bolted to skids in front of engine. No dead center. Start, stop, reverse at will.

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The

"Peck" Overlapping Bucket Carrier

most efficient service in handling cement, crushed rock, coal, ashes and other abrasive or gritty substances.

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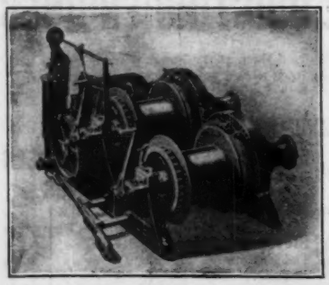

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A varied line of Patent Improved Grabs, including the Rawson Grab, the best digger of coal ever made.

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for stone crushing or dressing. The same sharp dust that wears a leather belt down in a few months seems only to toughen a *Gandy*, and the cost is but 1-3 that of leather.

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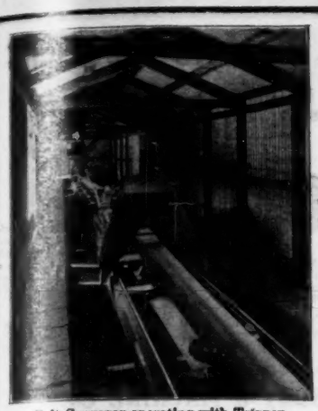

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Webster Continuous Handling Machinery

Designed, Manufactured and Installed for Sand, Gravel, Coal, Ores, Cement, etc.

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Sole Manufacturers of
SUCTION CONVEYORS for HANDLING MATERIALS
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You shovel in the ashes:—Zip!—They're gone. You find them in the Separator Tank.
All by suction through a pipe:—No moving parts:—Simple as A B C.

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Can be installed anywhere. No headroom required.
Twenty plants so far built; all in successful operation.
We have repeat orders from several customers, notably:

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Pretty good for a new thing? It solves the problem of ashes handling.

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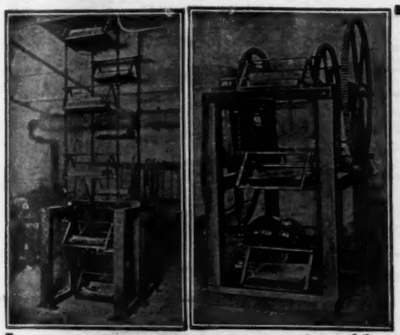

This illustration shows a Tray Elevator operating in one of the Weekly Magazine Publishing Houses in New York City for handling paper from Printing Presses. Elevator Trays 14 x 18 Inches, Centers of Elevator 25 feet, Travel 90 feet P. P. M. operated by 1 H.P. Motor 600 R. P. M. using the Clouser Detachable Link Chain.

Elevating Conveying and Power Transmitting Machinery

Coal and Ash Handling Systems. Coal Mining Machinery. Car Hauls. Cars. Industrial Railway Systems. Complete Grain Elevator Equipments.

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Agents wanted in all principal cities

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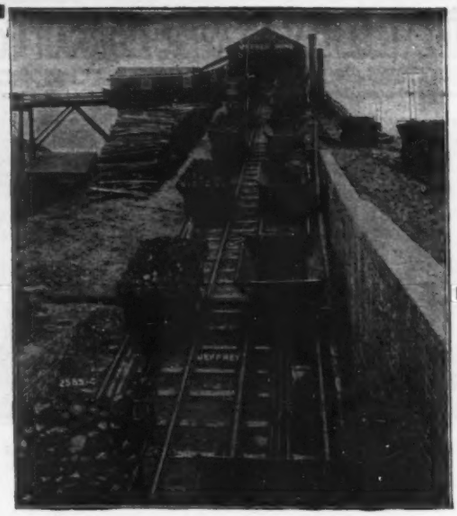
We also supply other standard makes of steel buckets, malleable buckets, etc.



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604½ feet long between terminals. Capacity per minute, 3 loaded cars each weighing 5500 pounds and three empties each weighing 1600 pounds. Speed of travel, 65 feet per minute.

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Elevators and Conveyers to handle material of all kinds, Screens, Crushers, Pulverizers, Coal Washeries, Electric Locomotives for Mine and Industrial Haulage, Coal Tipples, Coal Cutters, etc.

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are of inestimable value to contractors for handling concrete materials. Time and labor saved are items of great importance.

Freedom from breakdowns
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Simplicity and great carrying capacity
place our system far ahead of all competition.

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Coal is stored in the bins by means of an automatic railway.

Automatic Railways
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to carry the coal to the bins over the boiler.

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There is hardly a business in the manufacturing line to which we have not sold these goods, and have never had a system prove unsatisfactory.

Catalogue 73 D

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Guy Derrick Head Block

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Simplest Ever Made

Patented by
THE TERRY & TENCH COMPANY, Inc.
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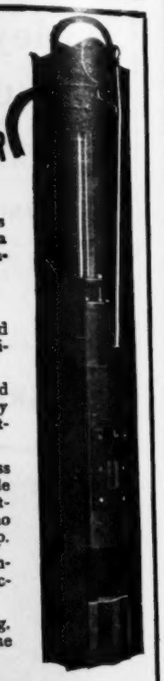
THE CRAM STEAM PILE HAMMER



Drives more piles in less time and where a drop hammer cannot.

Requires less attention and is most economical.

Its few parts and general simplicity assure its NOT getting out of order.

And its cleanness in driving the pile leaves it unshattered, requiring no removal of the top.

Prices are reasonable, and vary according to size.

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By C. W. REINHARDT — Price, $1.00
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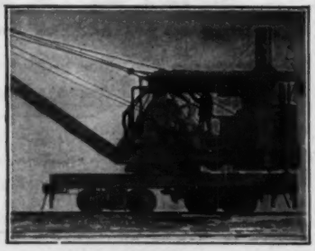
Yard and Road Service

With or Without Grab Buckets



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is so concentrated in Yale & Towne

Triplex Blocks

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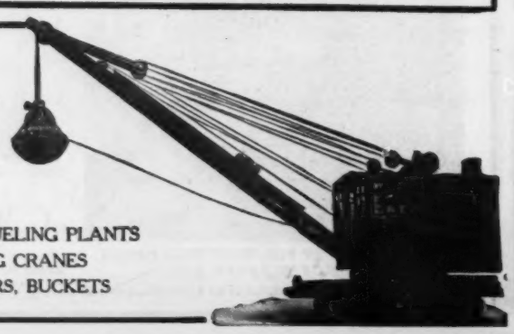

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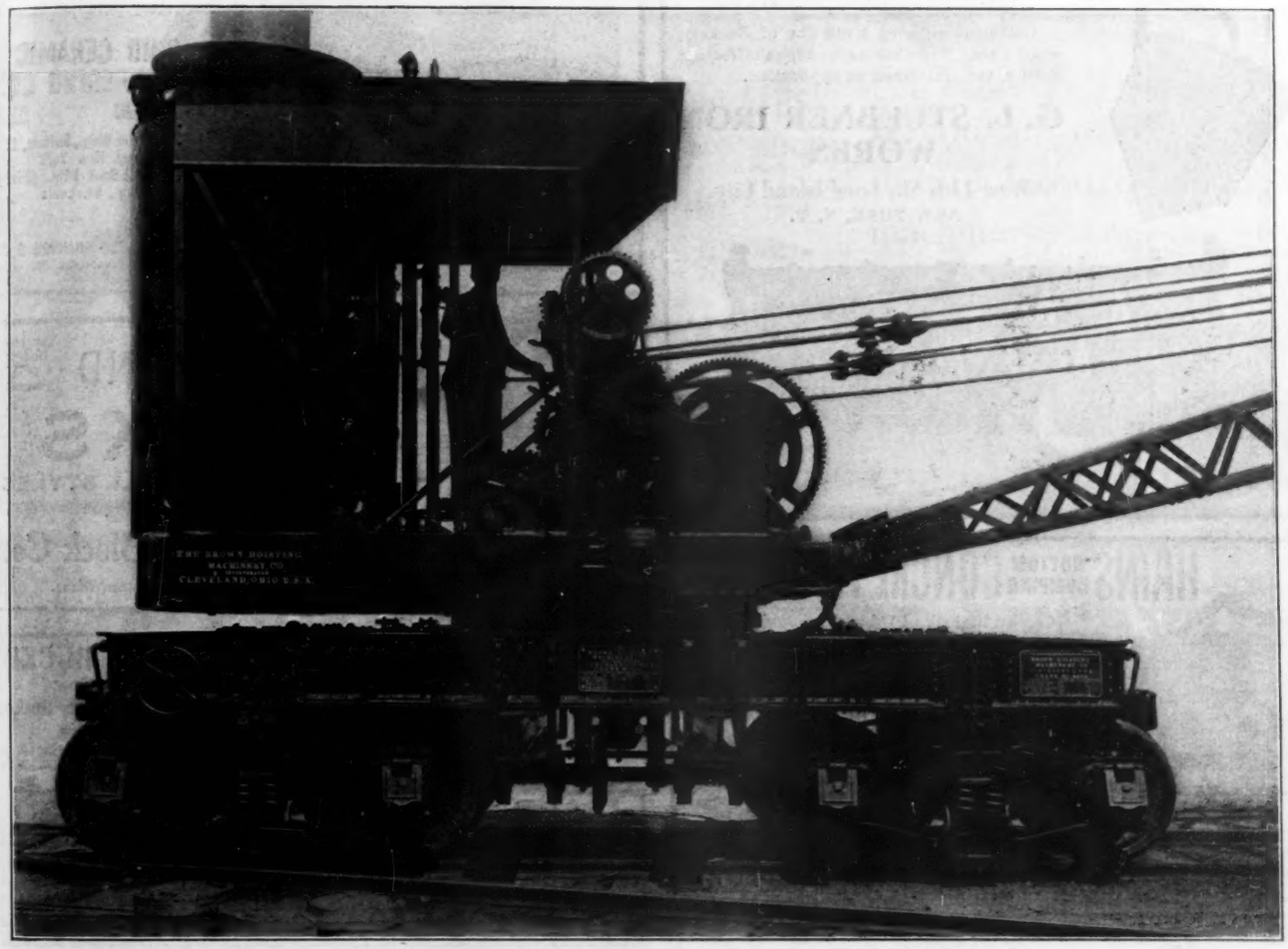

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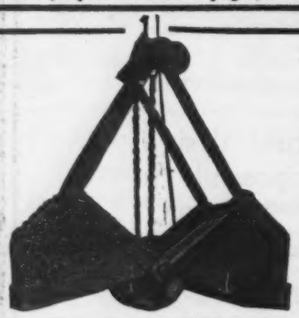

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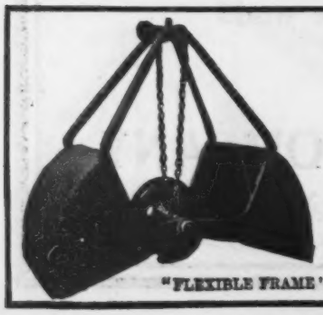

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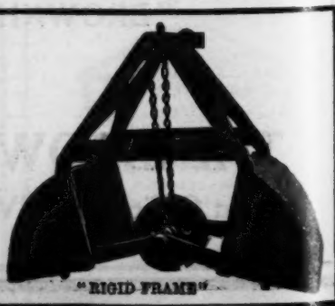

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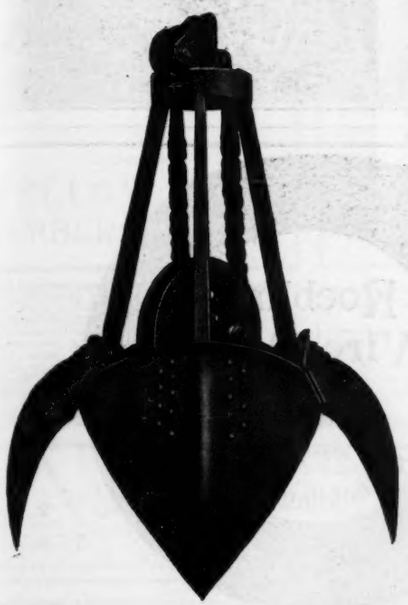

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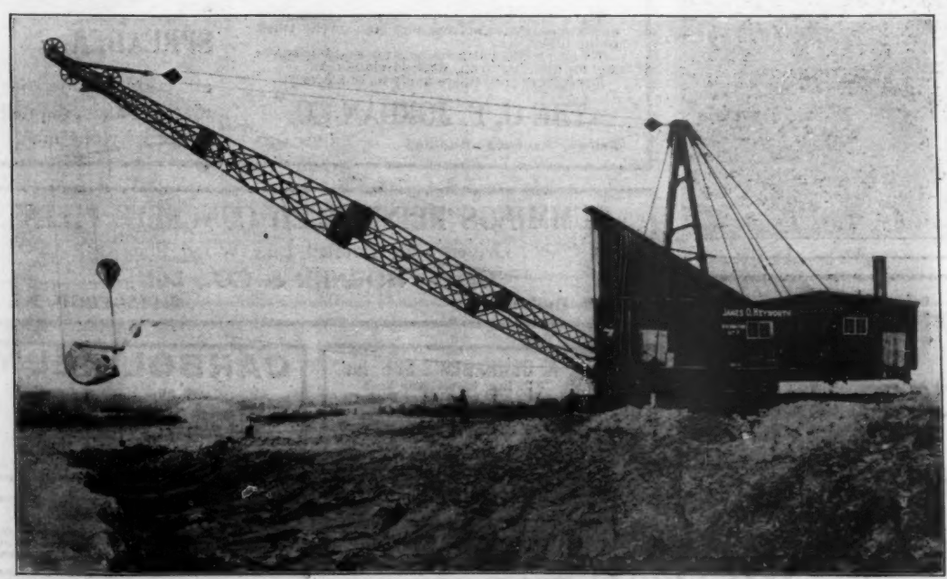

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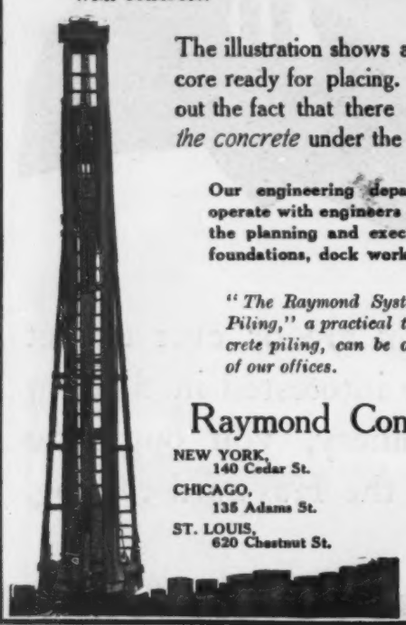

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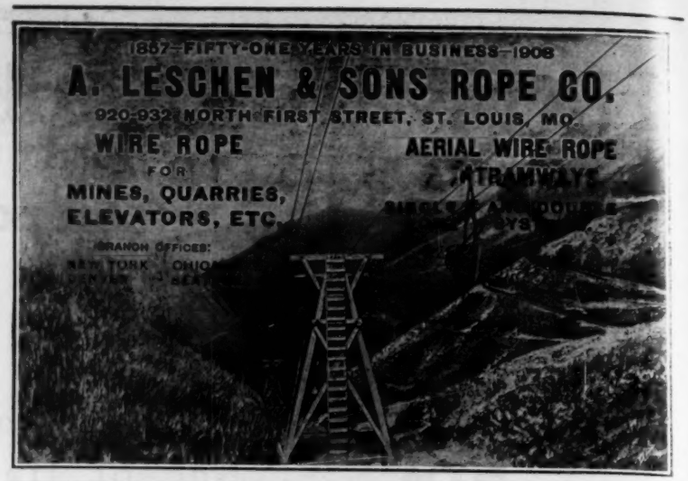

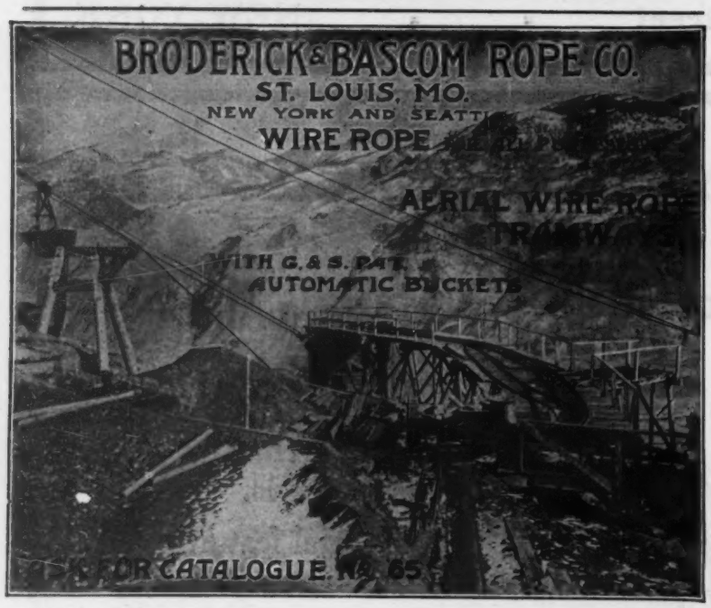

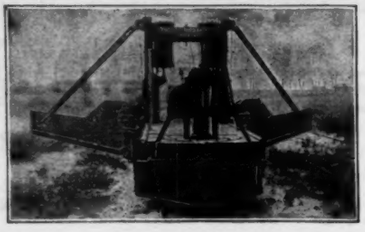

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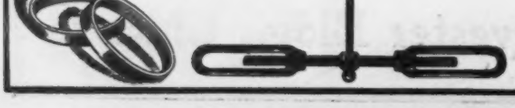

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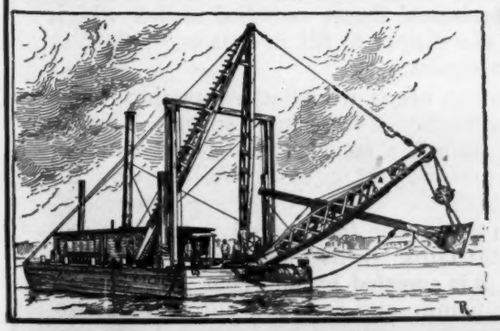

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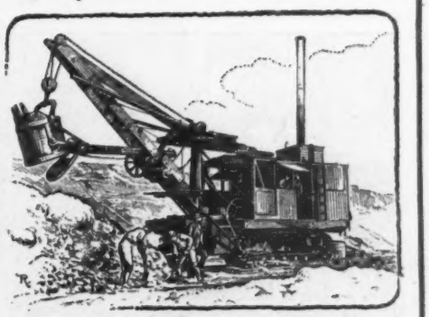

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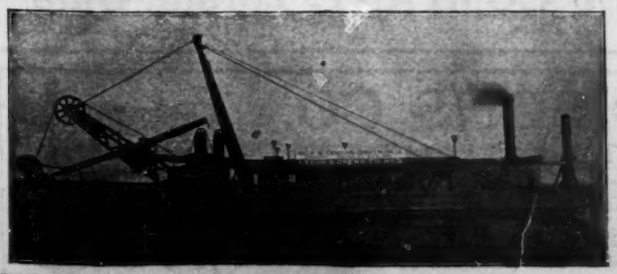

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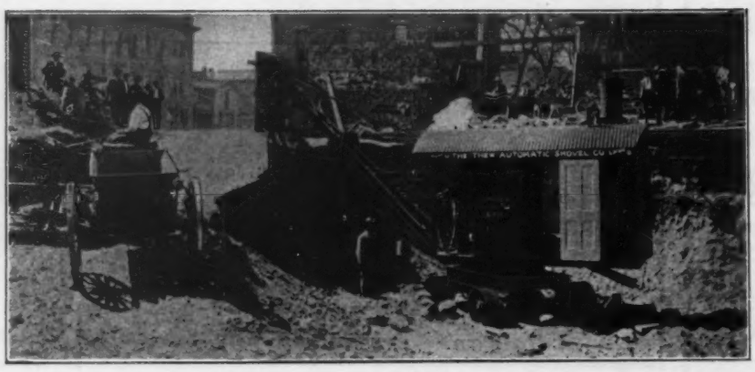

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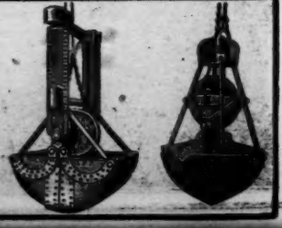

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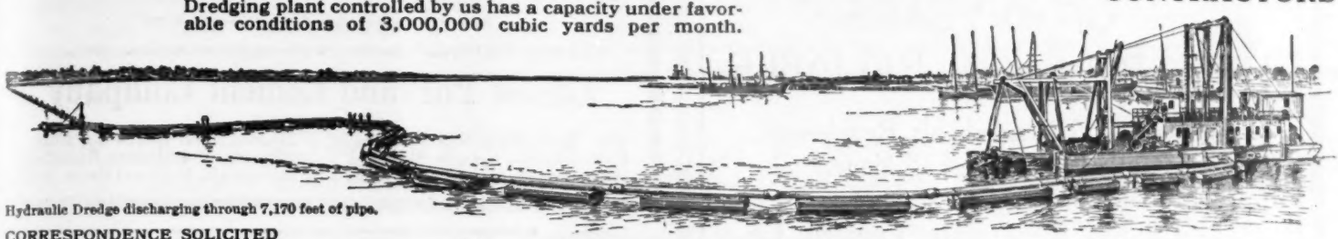

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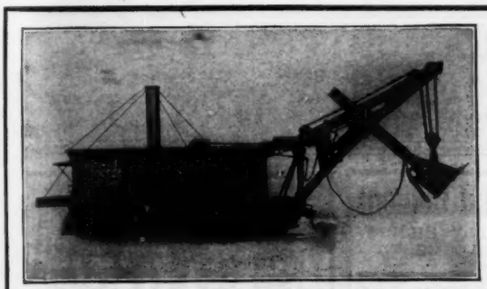

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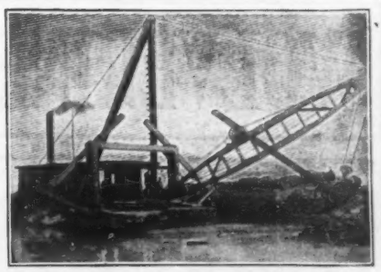

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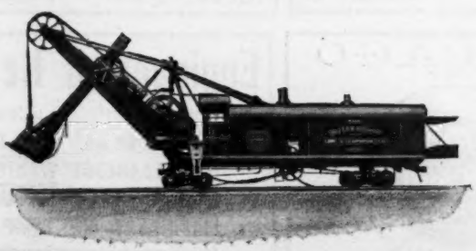

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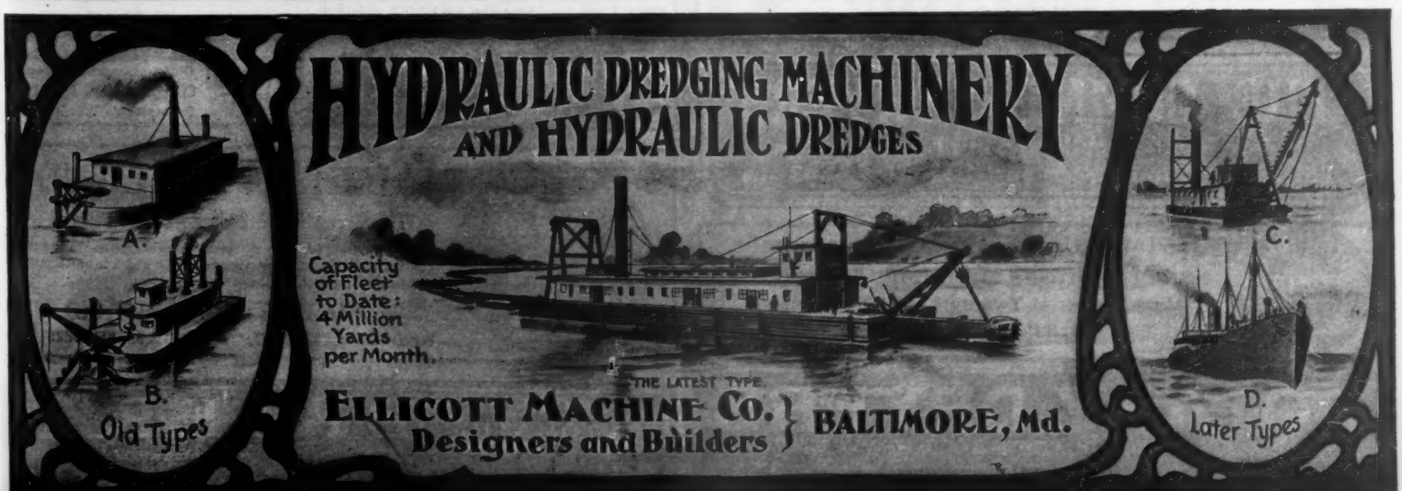

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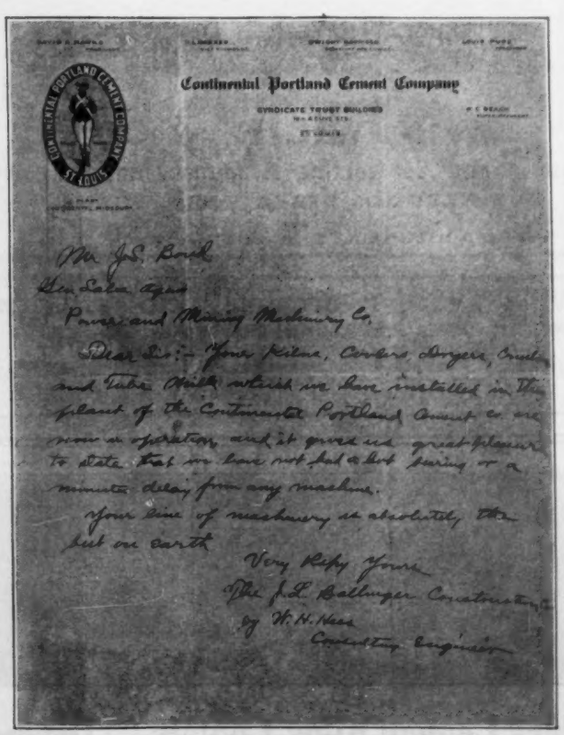
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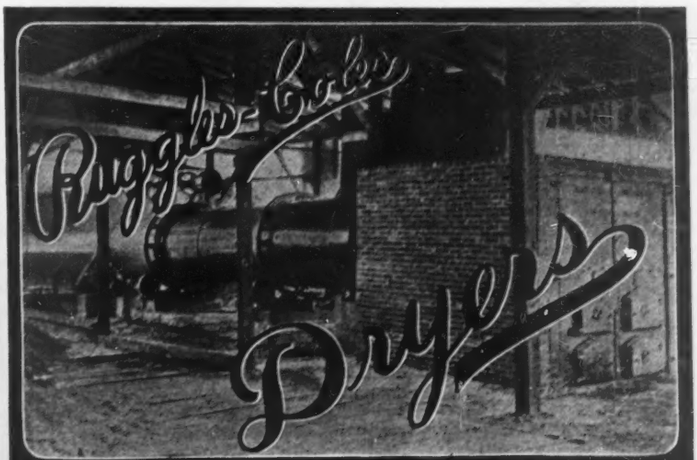

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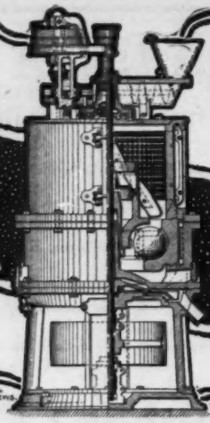

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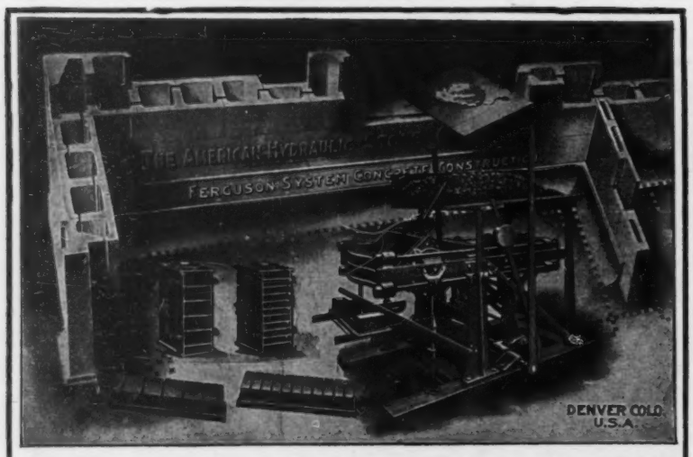

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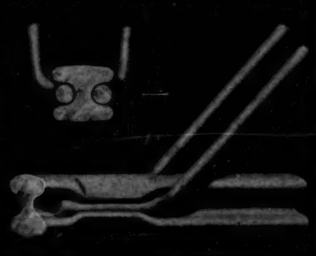

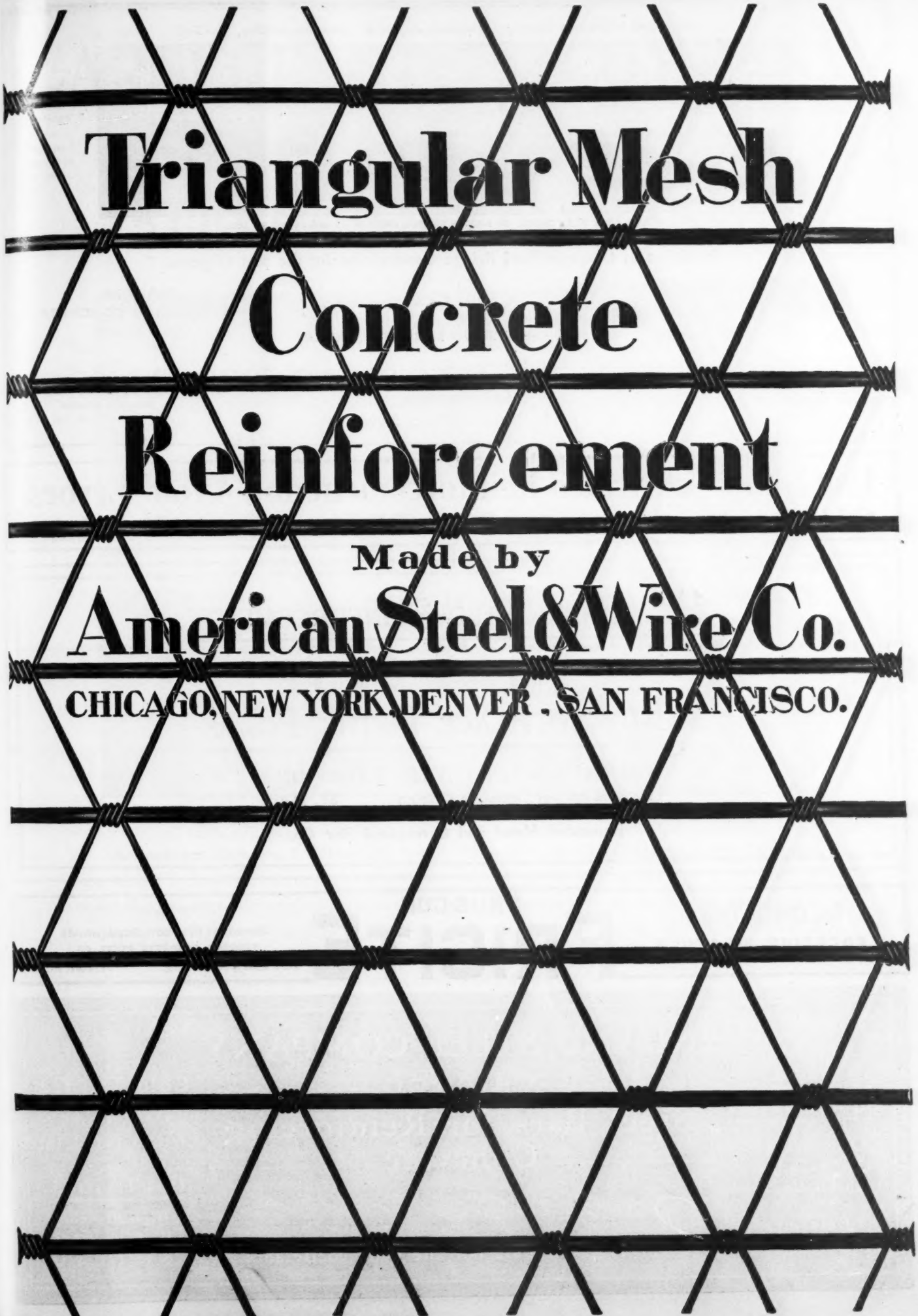
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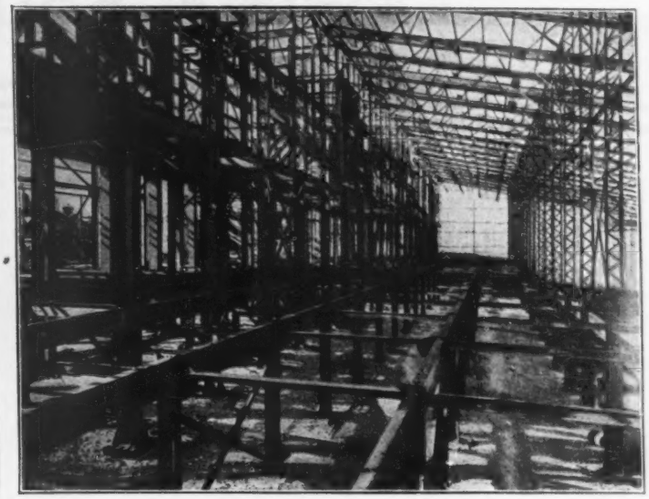

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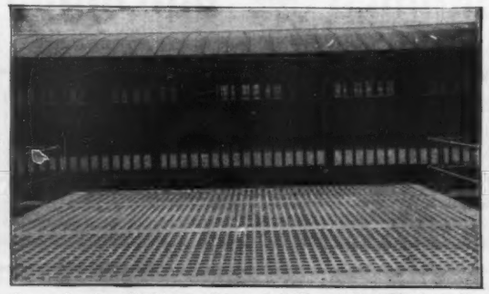

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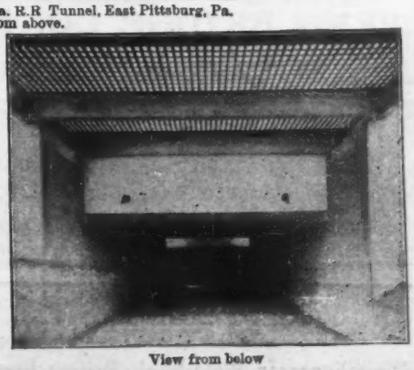

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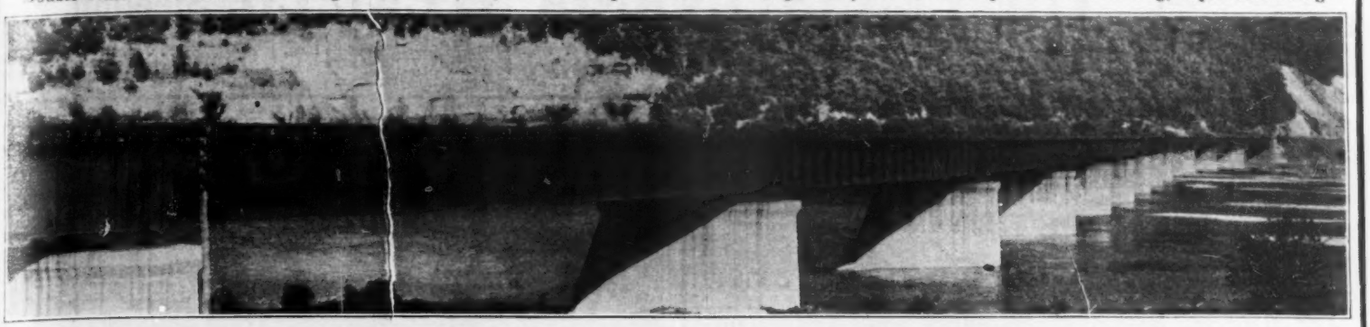

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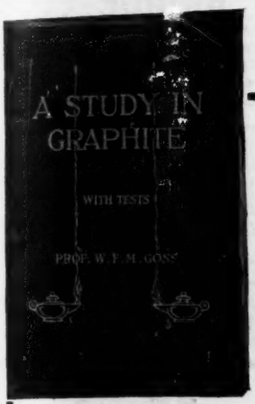

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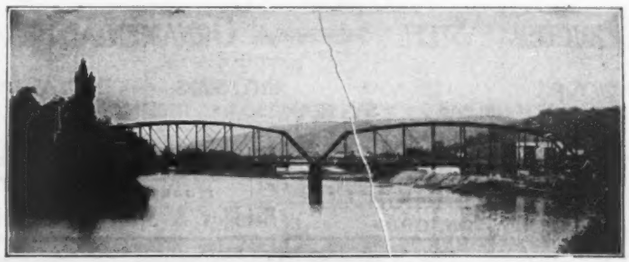

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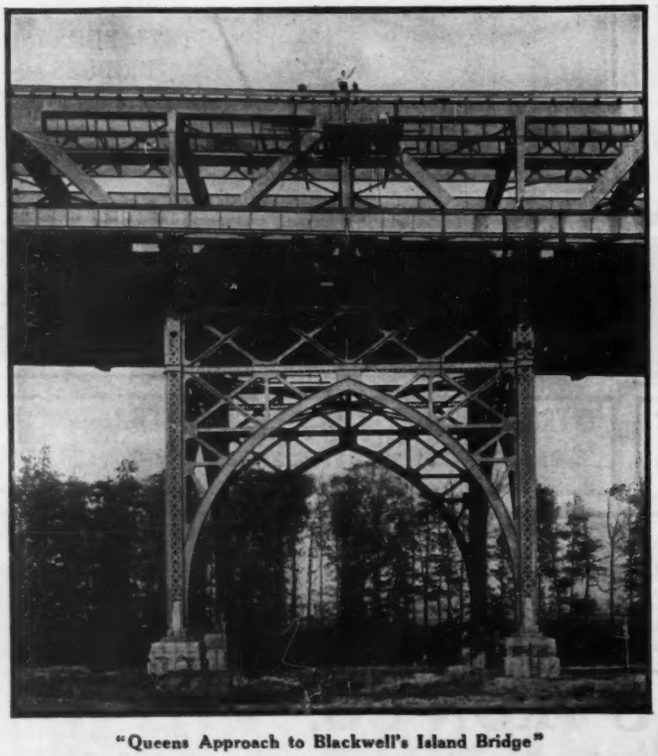

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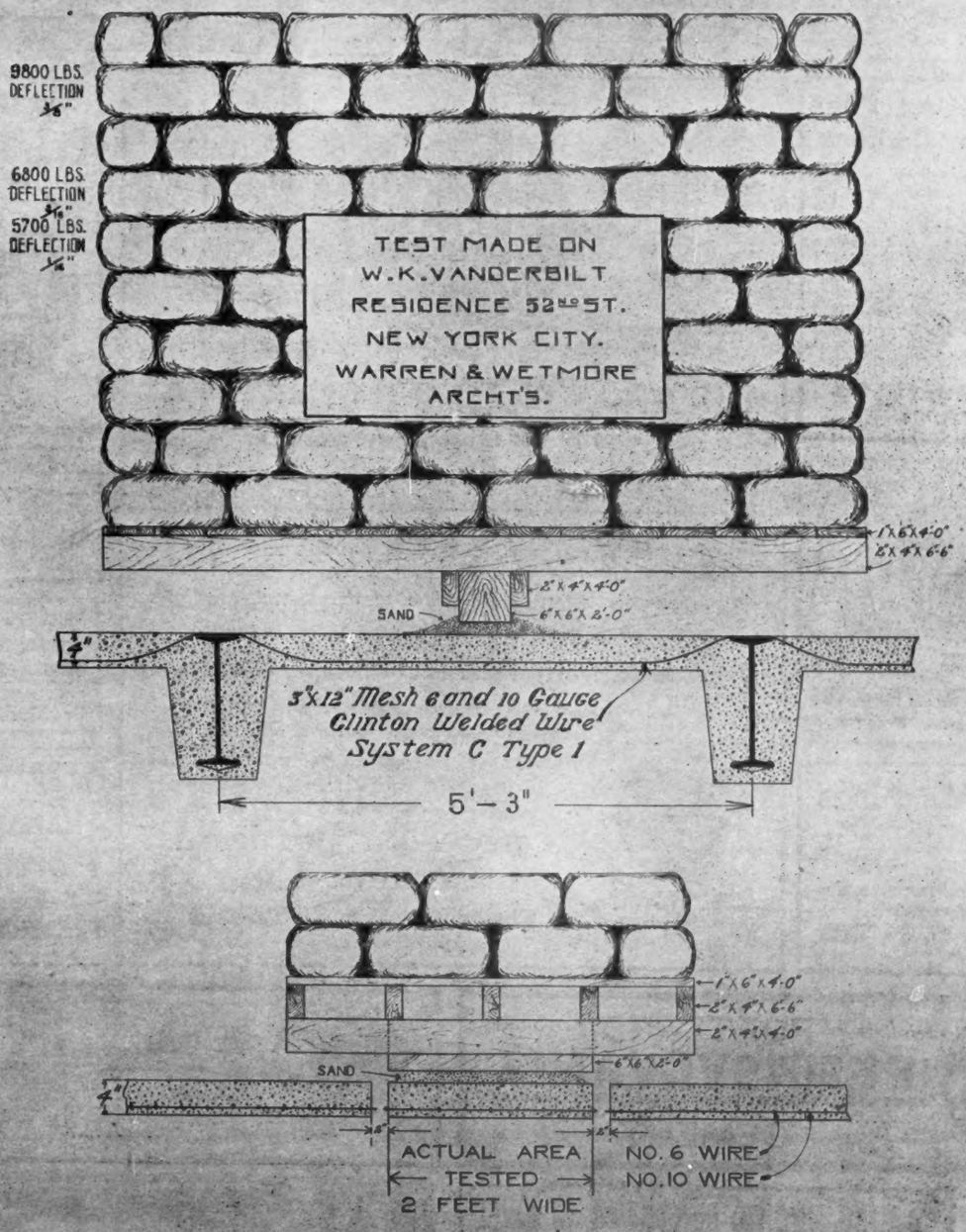

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